ASSESSMENT OF DOE'S CLEAN COAL TECHNOLOGY SOLICITATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS

OF THE

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SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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ASSESSMENT OF DOE'S CLEAN COAL TECHNOLOGY SOLICITATION

WEDNESDAY, SEPTEMBER 10, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Energy Development and Applications,
Washington, DC.

The subcommittee met, pursuant to call, at 9:37 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the subcommittee) presiding.

Mr. Fuqua. The subcommittee will be in order.

Today, we will hear from the Department of Energy and other very interested parties about the status of the country's Clean Coal Technology Program. As you know, this program is essentially a congressional initiative to encourage demonstration of technologies in order to better utilize our most abundant domestic resources; namely, coal.

These 2 days of hearings are designed to examine the Department of Energy's implementation of the program and to verify that it is indeed in line with congressional intent. Although the research results on acid rain damage are not at all complete, it appears that the utilization of coal will be greatly slowed unless technologies which mitigate effects from sulfur emissions are put in place. The DOE has made a selection of nine projects to negotiate for an award, and we have invited all awardees to testify. Seven of these project sponsors will appear as witnesses tomorrow. And since we are most anxious to have this program go forward, the DOE backup list of 14 projects is also of great interest to the committee. Proposers of five projects on this list will testify also, and we are looking forward to understanding better just how these sponsors can keep their technology teams together. This question, of course, raises the issue of a deadline for negotiations between the Department and the nine awardees.

The Clean Coal Technology Demonstration Program is one of the few bold thrusts in energy development, or energy technology development, since the late 1970's, and the committee's primary purpose should be to ensure a program's success through optimum use of resources. And I should remind my colleagues that these technology demonstrations are not done cheaply, and so we must better understand how the $350 million remaining in the clean coal reserve might be used to implement the program.

And I believe that it is worthwhile also to note that we are capturing valuable lessons learned in every day of operation of the

Great Plains Gasification project in North Dakota. Useful data is also being obtained from a new synthetic fuels project. It is easy to sit back and label such projects as white elephants based on near term sagging oil prices and the so-called glut. Yet anyone familiar with the nature of demonstration projects knows that there is no substitute for obtaining plant operation experience. The Clean Coal Technology Demonstration Program offers this opportunity across a spectrum of desirable technologies, and we are having these hearings to make certain that the country seizes this opportunity.

Today, we will hear from the Department of Energy and two panels of witnesses who will give us their assessment of the current status and progress of the Clean Coal Technology Demonstration Program.

Before we hear from DOE, I would like to, if there are any members—I think Mrs. Schneider has a comment she wishes to make.

Mrs. SCHNEIDER. Thank you, Mr. Chairman. I would just like to add that the joint report of the special envoys on acid rain, better known as the Lewis-Davis Report, does call on us to spend $5 billion for clean coal control technology as part of a demonstration project, and its outline is one that I am very anxious to see that we adhere to, given the great labors of Mr. Lewis and Mr. Davis.

I will say that the purpose of this research project and demonstration project is one whose time has long since passed. When we look in the East, over a thousand lakes have already been declared dead and over 4,000 lakes have virtually no buffering capacity whatsoever to neutralize acid rain. And a recent regional survey of southern pine found that there are growth reductions of 40 to 50 percent over the last 20 years, which is enormously significant, not to mention the impact of acid rain on our prime agricultural land or historic buildings and other buildings.

And in my own State of Rhode Island, it is interesting to note that there is 10 times more acidic than pure rain, and four out of the five of Rhode Island's most pristine waterways are either dying or endangered by acid rain. This is just one small State. We know that the damage is not only regional but global. And the sooner we define how best we are going to spend that $5 billion for clean coal technology, the more assured the United States will be of a solid and secure energy policy and enable coal technology to play a more significant role in the big picture overall.

So thank you, Mr. Chairman. I look forward to hearing from our witnesses today.

Mr. FUQUA. Thank you very much, Mrs. Schneider.

Our first witness is Mr. Don Bauer, the Acting Assistant Secretary for Fossil Energy from the Department of Energy.

And, Mr. Bauer, I want to congratulate you on your efforts in implementing the Clean Coal Technology Program, and we look forward to your comments.

STATEMENT OF DONALD L. BAUER, ACTING ASSISTANT SECRETARY FOR FOSSIL ENERGY, U.S. DEPARTMENT OF ENERGY, ACCOMPANIED BY JACK SIEGEL, DEPUTY ASSISTANT SECRETARY FOR CLEAN COAL COMBUSTION AND CONVERSION SYSTEMS

Mr. BAUER. Thank you, Mr. Chairman. Mr. Chairman, members of the subcommittee, I am pleased to appear before you this morning. I have submitted a formal statement for the record, and with your permission, Mr. Chairman, I will summarize——

Mr. FUQUA. We will make that a part of the record.

Mr. BAUER. OK. And I will summarize the contents.

I would like to point out also that I have with me at the table this morning Mr. Jack Siegel, Deputy Assistant Secretary in Fossil Energy, under whose direction and guidance we will execute that program—provide the headquarters' program guidance and direction and the field will implement the program.

It was about nearly 9 months ago when Congress passed Public Law 99-190, which provided the funds for a cost-shared clean coal technology demonstration program. Congress instructed the Department to go beyond our traditional fossil energy R&D program and assist industry in constructing and operating facilities to demonstrate the commercial feasibility of a new generation of coal technologies.

Today, that program is well underway. Nine projects have been selected for negotiation for cooperative agreements. And those nine projects represent several things. First, a wide diversity of energy markets, including both utility and industrial applications. Two, a broad array of technologies, including concepts that can be applied as retrofits or as grassroots facilities. Three, the potential for significantly reducing nationwide emissions of suspected acid rain-causing pollutants in a more cost-effective manner than is possible with today's conventional pollution control technology. Four, the potential for reintroducing coal into markets that are currently dominated by oil and gas. And, five, a financial commitment from industry well in excess of the congressionally required 50 percent cost sharing.

So, Mr. Chairman, the first several pages of my prepared statement describe the background of the clean coal initiative, including the method we used to evaluate the 51 proposals received by the April 18 deadline. I would like to summarize this process by stating briefly that the proposals were first required to meet six qualification criteria, and they are: One, the project must be located in the United States; two, the project must use U.S. coals; three, at least 50 percent of the costs must be provided by the private sector; four, the project must have an available site; five, it must comply with the Clean Air Act requirements; and six, the teaming arrangement, if one was proposed, must be sufficient.

Also, the proposals must have contained sufficient technical, cost and other information to enable a comprehensive evaluation, and the proposal had to be signed by a responsible official.

Twelve proposals failed to satisfy one or more of those requirements, leaving 39 to proceed on to comprehensive evaluation. During the comprehensive evaluation, the offerors' technical, business and management, and cost proposals were reviewed by a board of technical, legal and procurement specialists.

The board's evaluation was forwarded to me as the source selection official. In addition to the board's findings, I considered three program policy factors:

The first one, the desirability of selecting projects that can represent a diversity of methods, technical approach, or applications.

Two, the desirability of projects that could utilize a broad cross section of the U.S. coal resource base.

And, three, the desirability of projects that represent a balance between expanding the use of coal and minimizing environmental impacts.

I was also required to consider the candidate projects in the context of compliance with the National Environmental Policy Act (NEPA). I have described this compliance process in more detail in my statement.

So after considering the evaluation criteria, the program policy factors, and the NEPA strategy, I selected the nine proposals that, as a group, best further the goals and objectives of the solicitation. My selection statement is attached to my testimony. In addition to describing the selected projects, it also contains an addendum that lists the 14 proposers we would turn to in the event that discussions with one or more of the selected nine offerors does not end in a satisfactory arrangement.

The nine selected offerors have been contacted directly by our Pittsburgh and Morgantown Energy Technology Centers and activities are underway. These activities lead and are presently part of detailed negotiations for final cooperative agreements.

Once DOE is satisfied that each cooperative agreement is ready for signature, a report on that specific project will be submitted to Congress at least 30 calendar days prior to the execution of that cooperative agreement as required by law.

The first of the cooperative agreements may be signed by the end of this calendar year, and we are sure eager to conclude negotiations with each of the selected offerors as soon as possible.

The technologies proposed by the nine selected firms represent 7 of the 10 categories of coal technologies for which proposals were received. Many of the proposed technologies could, if successfully demonstrated, offer alternatives that are more economical or efficient than conventional methods for reducing sulfur dioxide and nitrogen dioxide emissions.

At least five of the projects would have specific application as a retrofit or repowering option for existing plants. These objectives, lower cost environmental control and retrofittable technology, are two of the principal areas emphasized by the joint report of the special envoys on acid rain as well as by others who have advocated additional funding for clean coal demonstrations.

The Department believes that a decision regarding further use of the Clean Coal Technology Reserve Fund should await the clean coal technology agreements now entering negotiations. We cannot be assured that these will be the projects ultimately receiving financial assistance since we are now in negotiations. Any recommendations we could make for the most efficient use of the $350 million remaining in the reserve could thus change significantly if we are unable to reach satisfactory agreements with one or more of the selected nine proposers and must look to the second list of proposers.

In addition, we believe it would be prudent to consider the outcome of State clean coal funding initiatives as well as other private sector initiatives.

Finally, Mr. Chairman, the committee expressed an interest in the financial cost sharing proposed for the nine selected projects. This is one aspect of the clean coal program that pleased us in particular. But due to the business confidential nature of the proposals and the fact that we are actively in the middle of negotiations, I cannot at this time discuss specific financial aspects of each of the proposals. However, while individual funding cannot be disclosed until negotiations have been completed, the proposed cost sharing, as depicted on page 13 of my prepared statement, reflects a significant willingness by the offerors to participate financially in the demonstration of new clean coal projects.

The total value of the selected nine projects, based on the evaluated probable costs, is $962 million. Of this total, $601 million, or 62.5 percent, will be contributed by the private sector and $361 million, or 37.5 percent, will come from the government. This cost sharing, which is well in excess of the congressionally mandated minimum, is a clear indication that the private sector is ready to back these technologies with a strong financial commitment.

That completes my prepared testimony, Mr. Chairman. I will be pleased to answer any questions that the committee may have of me at this time. Thank you.

[The prepared statement plus attachment of Mr. Bauer follow:]

Statement of Donald L. Bauer
Acting Assistant Secretary for Fossil Energy
U.S. Department of Energy
Before the
Subcommittee on Energy Development and Applications
Committee on Science and Technology

September 10, 1986

Mr. Chairman and Members of the Subcommittee:

Nearly nine months ago, on December 19, 1985, the Congress passed Public Law 99-190 which provided funds for a government-industry, cost-shared, clean coal technology demonstration program. The purpose was to go beyond our traditional, ongoing fossil energy R&D program by assisting the private sector in constructing and operating facilities that would demonstrate the commercial feasibility of a new generation of coal technologies.

Today, the Clean Coal Technology demonstration program is well underway. Nine proposed projects have been selected for negotiation of cooperative agreements. The nine projects represent:

1) potential applications in a wide diversity of energy markets, including both utility and industrial applications;

2) a broad array of technologies, including concepts that can be applied as retrofits to existing plants as well as those that would be suitable for "grass roots" facilities;

3) the potential for significantly reducing nationwide emissions of suspected acid rain-causing pollutants in a more cost-effective manner than is possible with today's conventional pollution control technologies;

4) the potential for reintroducing coal into markets currently dominated by oil and gas; and

5) a financial commitment from industry well in excess of the the Congressionally-required 50 percent cost sharing.

In short, the Clean Coal initiative, coupled with the Department's ongoing R&D programs as well as private sector activities, should expand the nation's technological base in the 1990s and beyond, permitting the U.S. to fully utilize our most abundant fossil energy resource without compromising the quality of our environment.

Background of Program

In response to the Congressional directive, the Department issued a Program Opportunity Notice (PON) on February 17, 1986. With the receipt of 51 proposals by the April 18, 1986, deadline, the Department initiated a rigorous evaluation process that extended over three months.

Before proposals were accepted for comprehensive evaluation, they were required to meet three Preliminary Evaluation requirements, the first of which was a set of six Qualification Criteria: (1) project location in the U.S., (2) the use of coal from U.S. mines, (3) at least 50 percent cost-sharing, (4) demonstration site availability, (5) compliance with Clean Air Act requirements, and (6) sufficiency of the teaming arrangement if one was proposed. The remaining two Preliminary Evaluation requirements were that the proposal contain sufficient technical, cost, and other information to enable Comprehensive Evaluation, and that the proposal be signed by a responsible official of the proposing organization.

As a result of this Preliminary Evaluation process, 12 proposals failed to satisfy one or more of the requirements, leaving 39 proposals to proceed to Comprehensive Evaluation.

Each of the offerors' Technical, Business and Management, and Cost Proposals were evaluated in accordance with specific criteria as identified in the PON. The PON provided that the Technical Proposal was of significantly greater importance than the Business and Management Proposal, and the Cost Proposal was minimal. However, everything else being equal, the Cost Proposal was very important.

The evaluation of the Technical Proposal resulted in a numerical score for each of the seven evaluation criteria; three of the criteria were Commercialization Factors, and four were Demonstration Project Factors. The Business and Management proposal was evaluated to determine the business and management performance potential of the offeror. These criteria were adjectively rated but not point-scored. The Cost Proposal was evaluated to assess whether the proposed cost was appropriate and reasonable, and to determine the probable cost of the proposed project to the Government. The Cost Proposal also was used to assess the validity of the proposer's approach to completing the project in accordance with the proposed Statement of Work and the requirements of the PON. No point score was applied.

The Source Evaluation Board's evaluation and documentation were forwarded to me as the Source Selection Official. In addition to the Board's evaluation, I considered three Program Policy Factors: (1) the desirability of selecting projects that represent a diversity of methods, technical approaches, or applications, (2) the desirability of selecting projects that would ensure that a broad cross section of the U.S. coal resource base is utilized, both now and in the future, and (3) the desirability of selecting projects that represent a balance between expanding the use of coal and minimizing environmental impacts.

NEPA Strategy

As the Source Selection Official, I was also required to consider the candidate projects in the context of compliance with the National Environmental Policy Act (NEPA).

An overall strategy for compliance with NEPA was developed for the Clean Coal Technology Program that included both programmatic and project-specific environmental impact considerations. Two analyses were undertaken by the Source Evaluation Board and provided to me. The first, Pre-Selection Programmatic Environmental Impact Analysis, was prepared based on the information provided by the offerors and supplemented by the Board, as necessary. This analysis ensured that relevant environmental consequences of the Clean Coal Technology Program and reasonable programmatic alternatives were evaluated in the selection process. The second report, Pre-Selection Project-Specific Environmental Review, focused on environmental issues associated with individual projects.

The third element in the NEPA strategy will not be required until after financial assistance is awarded. At that point, the offeror must submit the environmental information specified in the section of the PON entitled "Information Requirements for the National Environmental Policy Act" (Appendix J). This detailed site- and project-specific information will be the basis for site-specific NEPA documents to be prepared by DOE for each selected project. Such NEPA documents will be prepared, considered, and published in full conformance with the statutory requirements and in advance of a go/no-go decision to proceed beyond preliminary design. Federal funds cannot be provided for detailed design, construction, operation and/or dismantlement until the NEPA process has been successfully completed; however, offerors may elect at their own risk to begin preparing the environmental material early to expedite the project.

After considering the evaluation criteria, the Program Policy Factors, and the NEPA strategy, I selected the nine proposals that, as a group, best further the goals and objectives of the PON.

Selection Statement:

The Selection Statement is attached to this testimony. The Statement reviews the history of the Program and describes the proposal evaluation process, the strategy for NEPA compliance, the basis for my selection, and the selected nine projects themselves.

Additionally, I have attached an Addendum to the Selection Statement that lists the fourteen offerors that we would turn to in the event that discussions with one or more of the selected nine offerors does not end satisfactorily. In accordance with the PON, these two documents were filed with the Environmental Protection Agency on July 30, 1986.

The PON also noted that DOE would prepare and submit to the Congress, following selection, a comprehensive report on the proposals received. This report has been completed and was distributed to the Congress on August 22, 1986.

A second report, assessing the degree to which the nine selected projects appear to be consistent with the recommendations in the Joint Report of the Special Envoys on Acid Rain (Lewis/Davis Report) is being prepared and will be forwarded to the Congress within the next several weeks.

Status of the Clean Coal Technology Program

The nine selected offerors have now been contacted directly by contracting officers from our Pittsburgh and Morgantown Energy Technology Centers and initial discussions are underway to obtain from the offerors clarification of ambiguities, missing information, etc. With regard to these submissions, these discussions will lead directly to the detailed negotiations of the final cooperative agreements. The negotiations have been given a high priority status at our Energy Technology Centers.

While the PON provided offerors with a "Model Cooperative Agreement", the cooperative agreements that will be awarded will incorporate provisions specific to each of the demonstrations. For example, one important element is the Statement of Work. Another is the section entitled "Cost Sharing and Project Cost Requirements." In accordance with the PON, the offerors are now required to submit to DOE a plan outlining their proposed schedule for recovering the Government's contribution should the project proceed beyond the cost-shared operating phase. The PON provided that this recovery be derived from the sum of net revenues from operations of the demonstration project beyond the operating phase of the cooperative agreement (in which case the net revenue from the operation, after operating costs, would be shared in proportion to the overall cost-share for the project) and from the commercial sale, lease, manufacture, licensing, or use of the demonstrated technology. Additionally, proceeds from the sale of project assets at the end of the cost-shared project would be shared in proportion to the overall cost-share for the duration of the project.

Each cooperative agreement will also require an environmental monitoring plan to ensure that significant site- and technology-specific environmental data are collected and disseminated.

Once DOE is satisfied that each cooperative agreement is ready for signature, a report on the specific project will be submitted to the Congress at least 30 calendar days prior to the execution of the cooperative agreement, as required by Public Law 99-190. (NOTE: This time period may, in actuality, be significantly longer than a true 30 days; the Law states that any day in which either House of Congress is not in session because of adjournment of more than three calendar days to a day certain, is not included in calculating the 30 day period.)

The first of the cooperative agreements may be signed by the end of the calendar year, and we are eager to conclude negotiations with each of the selected offerors as soon as possible.

The Selected Projects:

The following is a description of the nine selected projects:

- o American Electric Power Service Corp., (project location: Brilliant, OH) proposes to demonstrate pressurized fluidized bed combustion-combined cycle technology that could be used either for "grass roots" new plant applications or, as the offeror proposes, to retrofit or repower an existing facility.
- o The Babcock and Wilcox Co., (project location: Lorain, OH) proposes to extend an ongoing series of tests of the Limestone Injection Multistage Burner (LIMB) concept and to conduct a side-by-side comparison with the "Coolside" sorbent duct injection concept; both concepts are intended as retrofits to existing coal-fired facilities.

- Coal Tech Corp., (project location: Williamsport, PA) proposes to demonstrate an advanced slagging combustor with sorbent injection. Although designed to facilitate conversion of oil- and gas-fired units to coal, as the offeror proposes, the technology could also be retrofitted to existing coal-fired boilers to reduce emissions and enhance capacity, as well as be employed in new facilities.

- Energy and Environmental Research Corp. (project locations: Bartonville, Hennepin and Springfield, IL) would retrofit three types of coal-fired boilers with a gas reburning and sorbent injection concept to reduce sulfur dioxide and nitrogen oxide emissions.

- Energy International, Inc., (project location: Rawlins, WY) proposes to gasify unmineable, steeply-dipping underground subbituminous coal seams, then convert the product gas into clean liquid fuels using a surface indirect liquefaction process.

- General Electric Co., (project locations: Evendale, OH; Dunkirk, NY) proposes to demonstrate a fixed-bed gasifier integrated with hot-gas cleanup and an advanced turbine as a method of generating electricity for new power installations.

- The M. W. Kellogg Co., (project location: Cairnbrook, PA) proposes to construct a fluid-bed gasifier, hot-gas cleanup, integrated combined cycle system. Although the demonstration facility would be a new unit, the technology could also be used for retrofitting/repowering existing coal-fired utility boilers to increase generating capacity, extend plant life, and reduce emissions.

- Ohio Ontario Clean Fuels Inc., (project location: Warren, OH) proposes to demonstrate a coal-oil coprocessing liquefaction technique to produce refined products from coal.

- Weirton Steel Corp. (project location: Weirton, WV) proposes a direct iron ore reduction method that would replace the coke oven/blast furnace for steelmaking.

The technologies represented by these proposals represent seven of the 10 categories of coal technologies for which proposals were received. Furthermore, although Babcock and Wilcox and Energy and Environmental Research Corp. are in the same broad category of "flue gas cleanup," they are quite different. Likewise, while General Electric and M.W. Kellogg propose coal gasification-based systems, the projects are substantially dissimilar to each other.

Environmental Performance of Selected Projects

The capability of the selected technologies to contribute to an overall reduction in emissions of acid rain precursors, especially sulfur dioxide, is directly related to the extent to which these technologies are applied commercially. It is clear, however, that many of the proposed technologies could, if successfully demonstrated, offer alternatives that are more economical or effective than conventional methods for reducing sulfur dioxide and nitrogen oxide emissions both from new plants and existing facilities. Specifically:

o American Electric Power: The pressurized fluidized bed combustion technology provides "in situ" control of emissions of oxides of nitrogen and of sulfur dioxide. Injection of an alkali sorbent (calcite or dolomite) into the combustor bed captures sulfur dioxide released during the combustion process. At the operating conditions of the combustor, oxides of nitrogen emissions are less than the level presently allowed by the Environmental Protection Agency's New Source Performance Standards. The only downstream pollution control equipment needed is for the capture of particulate matter; either a conventional electrostatic precipitator or a fabric filter could be used. Fluidized bed combustion thus has the potential to control precursors of acid rain for both new and retrofit applications.

o Babcock and Wilcox: This project is specifically intended to reduce emissions from existing coal-burning boilers. The LIMB portion of the project is intended to demonstrate that nitrogen oxides and sulfur dioxide emissions can be reduced by 50 to 60 percent at a capital cost of at least $100 per kilowatt less than the cost of wet scrubbers. The "Coolside" part of the project is designed to control sulfur dioxide emissions by dry sorbent injection with humidification. Again, the immediate application would be to retrofit existing boilers to control acid rain precursors.

o Coal Tech Corp: This project would employ a slagging combustor to control or remove the sulfur and particulate matter from coal-derived fuel prior to its injection into the retrofitted oil- or gas-fired boilers. Although intended as a way of substituting coal in many existing applications now dependent upon oil or gas, this device can also be used for new coal-fired facilities. The advanced slagging combustor controls particulates by converting the ash into molten slag rather than allowing the particles to enter the boiler.

Formation of nitrogen oxides is controlled by staged combustion to suppress temperatures, and sulfur dioxide is reduced by the injection of alkali compounds during combustion to capture the sulfur. The offeror's objectives include 90 to 95 percent coal ash retention and rejection, nitrogen oxide emissions of 100 parts per million or less, and sulfur dioxide emission reductions of 70 to 90 percent.

- Energy and Environmental Research: This project employs sorbent injection with gas reburning and is specifically intended to control nitrogen oxides and sulfur dioxide emissions from existing coal-fired boilers. The project's goal is to reduce nitrogen oxide emissions by 60 percent and sulfur dioxide emissions by 50 percent. The calcium-based sorbents are injected either with the burnout air above the reburning zone where the combustion is completed, or downstream between the air preheater and the electrostatic precipitator.

- Energy International: The purpose of this project is to apply underground coal gasification technology to the subbituminous coal deposits of Wyoming. The offerors plan to produce up to 2000-4000 barrels of middle distillate liquids using fixed-bed indirect liquefaction technology. While the concept is not an acid rain mitigating technology per se, the product gas is treated with state-of-the-art cleaning methods to remove tars, particulate matter, compounds of nitrogen, and compounds of sulfur. Thus, the process could lead to reduced emissions of acid rain precursors if the commercialized technology yields clean product fuel gas.

- General Electric: This project will use an integrated coal gasification, steam-injected gas turbine power plant to demonstrate the feasibility of simplified gasification systems for commmercial coal-to-electricity applications. The project will employ zinc ferrite sulfur removal technology. Although the process is best suited for new power installations, its commercialization could lead to significantly reduced emissions of sulfur dioxide since the new units would replace conventional coal combustion systems.

- M.W. Kellogg: This proposed project would demonstrate an advanced integrated coal gasification-combined cycle (IGCC) system involving an ash agglomerating fluidized bed gasification process using in-bed desulfurization with advanced hot gas cleanup for control of particulate matter and supplemental control of sulfur dioxide. The supplemental hot gas cleanup process will use a zinc ferrite sorbent bed. This technology has the potential to be used both for retrofit or repowering of existing units and for new sources of power.

- Ohio Ontario Clean Fuels: This demonstration is for a prototype coal/oil coprocessing plant that will convert high sulfur, high nitrogen-content, Ohio bituminous coal and poor-quality petroleum residues into clean liquid fuels. The technology offers the potential for using high sulfur coal in an environmentally acceptable manner. Also, the technology produces clean liquid fuels that could lead to reduced emissions of acid rain precursors.

- Weirton Steel: This demonstration project will use the Kohle Reduktion (KR) process developed by the West German firm of Korf Engineering. The technology would replace the two-step coke oven/blast furnace approach to producing pig iron with an integrated two-component oxygen-blown blast furnace system. Sulfur is captured in the fluidized-bed coal gasifier portion of the process by limestone injection and the off-gases are scrubbed for particulate control. The environmental advantage of this technology is that a large portion of the fugitive air emissions produced by conventional ironmaking is eliminated, thus substantially reducing the environmental impact.

Usefulness of Additional Funding

The selected technologies include candidates that have the potential to control acid rain precursors at a lower cost than today's commercially available technologies. At least five of the projects would have specific application as a retrofit or repowering option for existing plants. These objectives -- lower-cost environmental control and retrofittable technology -- are two of the principal areas emphasized by the Joint Report of the Special Envoys on Acid Rain as well as by others who have advocated additional funding for clean coal demonstrations.

The department believes that a decision regarding further use of the Clean Coal Technology Reserve Fund should await the Clean Coal Technology cooperative agreements now entering negotiations. The nine selected projects represent a broad array of technologies and applications and thus fulfill the requirements of both the Clean Coal initiative and the Joint Report. If these projects are fully successful, there may be no need for additional Federal activity. However, we cannot be assured that these will be the projects ultimately receiving financial assistance. Any recommendations we could make for the most effective use of the $350 million remaining in the reserve fund could thus change significantly if we are unable to reach satisfactory agreements with one or more of the nine selected proposers and therefore must look to the second list of proposers.

In addition, we believe it would be prudent to consider the outcome of state clean coal funding initiatives (in Ohio, for example) as well as other efforts such as private initiatives already underway in fluidized bed utility retrofits and activities conducted by the Electric Power Research Institute, before reaching a conclusion on further federal funding.

Cost-Sharing

Guidance provided in the PON permitted private sector cost participation as either direct or indirect costs, and the PON described how value could be determined for fully depreciated or currently depreciating property contributed to the project, as well as contributed land, equipment, facilities and the cost of disposal of the facility.

The PON also required a financing plan that specified the sources of all funds needed for the proposer's share of the costs. Offerors were to discuss the degree of certainty that the funds would be available when required, including a full description of any liabilities, limitations, conditions, and other factors affecting the availability of the funds. Proposers were also to describe any existing federal, state, and local tax, regulatory, or other incentive(s) included in the financing plan, and an explanation of their overall impact on the successful completion of the project. Regarding financial condition and capability, the proposer was to provide in the Business and Management Proposal current financial statements for all quarters reported on in the current fiscal year, and an audited financial statement for the prior three fiscal years. Financial statement instructions were also provided for newly-formed entities that were submitting proposals.

Both the adequacy and completeness of the participant's financing plan, and the financial condition and capability of the proposer to provide the non-federal cost share, were criteria that were evaluated prior to selection. Due to the business confidential nature of the information and the fact that we are actively engaged in negotiations, I cannot discuss specific financial aspects of the proposals at this time. However, while individual funding amounts cannot be disclosed until negotiations have been completed, the proposed cost sharing, as depicted below, reflects a significant willingness by the offerors to partipate financially in the demonstration of these new clean coal concepts:

	Average Participant Share (%)	Average DOE Share (%)
American Electric Power Service Corporation	66	34
Babcock & Wilcox	61	39
Coal Tech Corp.	50	50
General Electric Company	50	50
Energy & Environmental Research...	50	50
Energy International Inc.	51	49
The M.W. Kellogg Company	50	50
Ohio Ontario Clean Fuels Inc......	80.1	19.9
Weirton Steel Corporation	64.6	35.4

The total value of the selected nine projects, based on the evaluated probable costs, is $962 million. Of this total, again based on evaluated probable costs, $601 million or 62.5 percent will be contributed by the private sector, and $361 million or 37.5 percent will come from the Government.

The Fourteen Alternate Projects:

Throughout my testimony I have emphasized the fact that we are proceeding with negotiations toward cooperative agreements with the nine selected offerors. It is, of course, entirely possible that a successful conclusion may not be reached with one or more of the organizations. In that event, as was noted in the Department's July 25, 1986, press announcement, and as is described in the Addendum to the Selection Statement, fourteen alternate projects were chosen that would then be considered.

Should it become necessary to select an additional project(s), the second group of proposals would be judged using the same evaluation criteria and program policy factors identified in the PON.

Because the alternate projects remain viable contenders until the last of the cooperative agreements are executed, I cannot fully discuss their individual merits; however, I can review the project location, proposed technology, application of the technology, and the product of the application. In alphabetical order, the alternate group includes:

1. Colorado-Ute Electric Assoc. Inc.:
    TITLE: Nucla Circulating Fluidized Bed Demonstration Project.
    LOCATION: Nucla, Colorado
    TECHNOLOGY: Pyropower circulating fluidized bed combustor.
    APPLICATION: Electric Utility.
    PRODUCT: Electricity.

2. Combustion Engineering. Inc.:
TITLE: A Clean Coal Demonstration Program for the United States Electric Power Industry.
LOCATION: Homer City, Pennsylvania; Windsor, Connecticut; and Alliance, Ohio.
TECHNOLOGY: Combustion of medium- and deep-cleaned coals in tangential- and wall-fired combustion systems
APPLICATION: Electric utility.
PRODUCT: Cleaned coal.

3. Consolidation Coal Co. with Foster Wheeler Power Systems, Inc.:
TITLE: West Virginia University Clean Energy Project.
LOCATION: Morgantown, West Virginia
TECHNOLOGY: Gasification combined cycle with hot gas cleanup.
APPLICATION: Electric utility, cogeneration plants, and industrial.
PRODUCT: Electricity, steam.

4. McDonnell Douglas Energy Systems. Inc.:
TITLE: Demonstration of an Advanced Physical Coal Cleaning Technologyo.
LOCATION: Shelbyville, Kentucky
TECHNOLOGY: Advanced microbubble flotation coal cleaning process.
APPLICATION: Electric utility, industrial boilers, waste stream product recovery at coal preparation plants.
PRODUCT: Cleaned coal.

5. Minnesota. State Department of Natural Resources:
TITLE: COREX Process Proposal.
(COREX is described by the offeror as a "direct-smelting process developed by Korf Engineering GMBH.")
LOCATION: Mt. Iron, Minnesota
TECHNOLOGY: Production of pig iron from iron ore and coal in a melter/gasifier using the Korf Enqineerinq COREX (also known as KR) process.
APPLICATION: Industrial.
PRODUCT: Pig iron for steel making.

6. Southwestern Public Service Co.:
TITLE: Nichols Station Unit 3 Circulating Fluidized Bed Repowering Project.
LOCATION: Amarillo, Texas
TECHNOLOGY: Circulating atmospheric fluidized bed combustion.
APPLICATION: Electric Utility.
PRODUCT: Electricity.

7. Tallahassee, City of:
TITLE: Arvah B. Hopkins Generating Station Unit 2 Circulating Fluidized Bed Replacement Boiler.
LOCATION: Tallahassee, Florida
TECHNOLOGY: Lurgi circulating atmospheric fluidized bed combustor.
APPLICATION: Electric utility.
PRODUCT: Electricity

8. Tennessee Valley Authority:
   TITLE: Lime Spray Dryer Flue Gas Desulfurization Demonstration on Medium-to-High-Sulfur Coal.
   LOCATION: Paducah, Kentucky
   TECHNOLOGY: Lime spray dryer with a baghouse.
   APPLICATION: Electric utility.
   PRODUCT: Environmental control technology.

9. Tennessee Valley Authority:
   TITLE: Once-Through Methanol Project.
   LOCATION: Muscle Shoals, Alabama
   TECHNOLOGY: Indirect liquefaction/once-through methanol/integrated gasification combined cycle.
   APPLICATION: As proposed, principally electric utility, but the methanol produced could have broad market applications.
   PRODUCT: Methanol and electricity.

10. TRW Inc.:
    TITLE: Utility Retrofit Demonstration Using TRW Slagging Combustor Technology.
    LOCATION: Orange and Rockland's Lovett Station in New York
    TECHNOLOGY: Advanced slagging coal combustor.
    APPLICATION: Retrofit and new utility and industrial boilers; conversions of oil- and gas-fired boilers to coal.
    PRODUCT: Steam and/or electricity.

11. United Coal Company:
    TITLE: Coal Waste Recovery - Advanced Technology Demonstration.
    LOCATION: Sharples, West Virginia
    TECHNOLOGY: Microbubble flotation and centrifugal drying of coal preparation wastes.
    APPLICATION: Upgrading or recovering coal refuse for combustion.
    PRODUCT: Cleaned coal.

12. Western Energy Company:
    TITLE: Advanced Coal Cleaning Process Demonstration.
    LOCATION: Colstrip, Montana (Rosebud County).
    TECHNOLOGY: Coal preparation.
    APPLICATION: Upgraded coal quality.
    PRODUCT: Cleaned coal.

13. Westinghouse Electric Corp.:
    TITLE: Clean Coal Fuel Cell Technology Program.
    LOCATION: Madison, Pennsylvania
    TECHNOLOGY: KRW coal gasifier and cleanup subsystem integrated with a phosphoric acid fuel cell power plant.
    APPLICATION: Integrated plants for electric utility use and for industrial cogeneration.
    PRODUCT: Electricity.

14. Wisconsin Electric Power Co.:

TITLE:	Port Washington Clean Energy Project.
LOCATION:	Port Washington, Wisconsin
TECHNOLOGY:	Turbocharged pressurized fluidized bed combustion.
APPLICATION:	New plant or retrofit to existing plant utility-size steam generators.
PRODUCT:	Electricity.

This completes my prepared testimony, Mr. Chairman. I will be pleased to answer any questions you or members of the Subcommittee may have.

Attachment: Source Selection Statement with Addendum.

CLEAN COAL TECHNOLOGY SELECTION STATEMENT

Attachment To The Prepared Statement

of

DONALD L. BAUER
Acting Assistant Secretary for Fossil Energy
U.S. Department of Energy

September 10, 1986

Selection of Proposals for the Demonstration of Clean Coal Technologies Program Opportunity Notice DE-PS01-86FE60966

On July 9, 1986, senior officials of the Department of Energy (DOE) and I met with the Source Evaluation Board (the Board) previously appointed to solicit and evaluate the proposals submitted in response to the Program Opportunity Notice (PON) for clean coal technology demonstration projects. The presentation of the Board consisted of a summary description of the proposals received, a summary of the evaluation process undertaken by the Board, and the Board's evaluation of the proposals. Immediately following the Board's presentation and on July 11, 1986, I met in executive session with the Senior Review Group, which was previously appointed to advise me based on the Board's findings and the program policy factors. DB

Program Description

On December 19, 1985, Pub. L. No. 99-190, "An Act Making Appropriations for the Department of the Interior and Related Agencies for the Fiscal Year Ending September 30, 1986, and for Other Purposes" (the "Act"), was signed into law. This Act, among other things, provided funds to conduct cost-shared clean coal technology projects for the construction and operation of facilities that would demonstrate the feasibility of future commercial applications of such technology.

The Act further required that DOE issue a "general request for proposals" for the Clean Coal Technology (CCT) Program within 60 days of the date of enactment (i.e. by February 17, 1986), provided 60 days from issuance of that request for the proposals to be submitted (i.e. by April 18, 1986), and required the selection of projects for negotiation no later than August 1, 1986. The CCT PON was issued in accordance with this requirement.

The Act makes available a total of $397.6 million for this program, as follows: $99.4 million in fiscal year 1986, $149.1 million in fiscal year 1987, and $149.1 million in fiscal year 1988. Of these monies, $25 million will be held in reserve to cover the cost of overruns in the event that the Government agrees to share such costs. In addition, $4.9 million will be reprogrammed for the Small Business and Innovative Research Program, and unavailable to the CCT Program. Also, funds have been set aside for contracting, travel, and ancillary costs incurred by the DOE in implementation of the CCT Program. The remaining $362,233,000 is available for award under this PON.

The PON was open to all market applications of clean coal technology that apply to any segment of the United States coal resource base, and encompassed both "new" and "retrofit" applications. The projects in this program are to be industry projects assisted by the Government.

Issuance of the PON

A draft PON was issued on January 30, 1986. The announcement that this draft was available for public comment was published in the Federal Register on January 27, 1986, and in the Commerce Business Daily on January 28, 1986. Public comments on the draft PON were received from 23 entities.

The final PON was issued on February 17, 1986. In response to the public comments received regarding the draft PON, and also as a result of the continued process of PON review undertaken by the Board, the final PON differed from the draft in a number of respects. Also, one amendment to the PON was issued on February 24, 1986, which revised sections of the PON relating to revenue sharing.

A total of 760 copies of the PON were distributed. The Source List was developed from the over 170 responses received in response to the DOE request for statements of interest in, and proposals for projects employing, emerging clean coal technologies, which was issued in accordance with section 321 of Pub. L. No. 98-473. This list was augmented by requests received in response to the January 27th Federal Register and January 28th Commerce Business Daily notices of availability of the draft PON.

To enable prospective offerors to gain a better understanding of the objectives of this PON and to receive answers in response to written questions submitted regarding the PON, a Preproposal Conference was held on March 6, 1986, at the GSA "Departmental Auditorium," 1301 Constitution Ave., N.W., Washington, D.C. 20024. Attendees also were afforded an opportunity to submit questions at the meeting. The DOE estimates that approximately 280 persons attended the Conference. On March 24, 1986, a comprehensive compilation of questions and answers ("Q's and A's") addressed at the Conference and questions deferred for subsequent response was issued to all recipients of the PON and to all Conference attendees. On April 9, 1986, a supplemental package of 5 Q's and A's was issued to address the inquiries received between March 24 and April 4, 1986.

The Evaluation Process

1. Proposals Received

On or before April 18, 1986, the closing date for submission of proposals, 51 proposals were received. The offerors, listed in alphabetical order by primary sponsoring organization, include:

American Electric Power Service Corporation
American Minerals, Inc.
Atlantic Research Corporation
Babcock & Wilcox
Calderon Energy Company
Charwill
ChemCoal Associates
Chemion Corporation
City of Tallahassee
Coal Tech Corp. (Marian, Pa.)
Coal Technology Corporation (Naples, Florida)
Colorado-UTE Electric Association
Combustion Engineering, Inc.
Community Central Energy Corporation (2 proposals submitted)
Consolidated Coal Company and Foster Wheeler Power Systems, Inc.
Curators of the University of Missouri
Dow Corning Corporation
Dravo Wellman Company
Elgin-Butler Brick Company
Energotechnology Corporation
Energy and Environmental Research Corporation
Energy International, Inc.
FMC Corporation
General Electric Company
McDonnell Douglas Energy Systems, Inc.
Minnesota Department of Natural Resources
National Lime Association
North Marion Development, Inc./MADIFCO
NOXSO Corporation
Ohio Ontario Clean Fuels, Inc.
Pennsylvania Coke Technology, Inc.
PPG Industries, Inc.
Questar Synfuels Corporation
Recovery Systems, Limited
Sanitech, Inc.
Southwestern Public Service Company
Stirling Energies, Inc.
Tennessee Valley Authority (2 proposals submitted)
The Cleveland Electric Illuminating Company
The M.W. Kellogg Company
TRW Inc.
United Coal Company
University of Cincinnati
University of Florida
Weirton Steel Corporation
Western Energy Company
Westinghouse Electric Corporation
Wisconsin Electric Power Company
Ztek Corporation

2. Public Abstracts

In order to enable DOE to provide to the public some information regarding the number and nature of proposals received in response to the PON, the PON required that each offeror provide a public abstract of not more than 500 words, which described the proposed project, the specific clean coal technology proposed, the objective, methodology, the sponsoring organization(s), and the timeframe. The offerors were further advised that this abstract might be released to the public, in whole or in part, at any time, and, therefore, should not contain proprietary data or confidential business information. On April 21, 1986, DOE issued a News Release that, among other things, announced that a compilation of public abstracts for candidate clean coal technology projects was available for public inspection.

3. Withdrawal of Proposal

In accordance with Section III.34 of the PON, "Late Submissions, Modifications, and Withdrawals of Proposals," Atlantic Research Corporation advised DOE in a letter dated July 9, 1986 of its decision to withdraw its proposal from consideration under the PON.

4. Preliminary Evaluation

The PON established Preliminary Evaluation requirements, and provided that failure to meet one or more of these requirements would result in rejection of the proposal. These requirements include qualification criteria, which address the location of the proposed project or facility, the use of coals from United States mines, the certifications required with respect to cost-sharing and Clean Air Act requirements, site availability, and the sufficiency of the teaming arrangement proposed.

In addition, the proposal was required to contain sufficient technical, cost, and other information to enable Comprehensive Evaluation, and was to be signed by a responsible official of the proposing organization authorized to contractually bind the organization.

Twelve proposals failed to satisfy one or more of these requirements, and, therefore, did not proceed to comprehensive evaluation. These offerors were so advised by letters dated May 16, 1986.

5. Comprehensive Evaluation

Proposal evaluation was conducted to determine the merits of each offeror's proposal in accordance with weighted evaluation criteria. The Technical Proposal evaluation resulted in a numerical score for each of the evaluation criteria.

The Business and Management Proposal was evaluated to determine the business and management performance potential of the offeror, and was used as an aid in determining the offeror's understanding of the technical requirements of this PON. The Business and Management Proposal was adjectively rated but not point-scored.

The Cost Proposal was evaluated to assess whether the proposed cost was appropriate and reasonable and to determine the probable cost of the proposed project to the Government. The Cost Proposal also was used to assess the validity of the proposer's approach to completing the project in accordance with the proposed Statement of Work and the requirements of this PON. No point score was applied.

To determine the overall merit of each proposal, the Technical, Business and Management and Cost sections were considered in accordance with the relative weights established in the PON. In particular, the PON provided that the Technical Proposal is of significantly greater importance than the Business and Management Proposal and that the Cost Proposal is minimal. However, everything else being equal, the Cost Proposal is very important.

5.1 Technical Evaluation Criteria

The Technical Evaluation Criteria were divided into two major categories. The first, "Commercialization Factors," addressed the projected commercialization of the proposed technology. The criteria in this category provided for consideration of the projected environmental, health, safety, and socio-economic impacts; the potential marketability and economics of the technology; and the plan to commercialize the proposed technology subsequent to the demonstration project.

The second major category, "Demonstration Project Factors," recognized that the proposed demonstration project represented the critical step between the "pre-demonstration" scale of operation and commercial readiness, and dealt with the proposed project itself. Criteria in this category provided for consideration of technical readiness for scale-up; adequacy and appropriateness of the demonstration project; the environmental, health, safety, and socio-economic and other site-related aspects; and the reasonableness and adequacy of the technical approach and quality and completeness of the Statement of Work.

5.2 Business and Management Evaluation Criteria

The Business and Management Evaluation Criteria provided for consideration of: (1) the degree of priority placed by top management on the project; (2) the adequacy, completeness, and reasonableness of proposed management plan; (3) the adequacy, completeness, and reasonableness of administrative and technical support; (4) the adequacy and completeness of the participant's financing plan; (5) the financial condition and capability of proposer to fund its proposed cost-share; (6) the proposer's experience and success in similar or related projects; and (7) the qualifications, experience and availability of proposed project key personnel.

6. Program Policy Factors

The PON also provided three program policy factors for consideration by the Source Selection Official in selecting proposals, which, when taken together, would best achieve the program goals and objectives. These program policy factors are:

(1) The desirability of selecting for support a group of projects that represent a diversity of methods, technical approaches, or applications;

(2) The desirability of selecting for support a group of projects that would ensure that a broad cross section of the U.S. coal resource base is utilized, both now and in the future; and

(3) The desirability of selecting for support a group of projects that represent a balance between the goals of expanding the use of coal and minimizing environmental impacts.

7. Discussions With Offerors

In light of the number of proposals received and the time constraints created by the statutory deadlines established for this program, there was no opportunity to engage in written or oral discussions prior to selection.

8. National Environmental Policy Act (NEPA) Strategy

An overall strategy for compliance with NEPA was developed for the CCT Program, consistent with the Council on Environmental Quality NEPA regulations and the DOE guidelines for compliance with NEPA. This strategy includes both programmatic and project-specific environmental impact considerations, during and subsequent to the selection process.

In light of the tight schedule imposed by Pub. L. No. 99-190 and the confidentiality requirements of the competitive PON process, DOE established alternative procedures to ensure that environmental factors were fully evaluated and integrated into the decisionmaking process to satisfy its NEPA responsibilities. Offerors were required to submit both programmatic and project-specific environmental data and analyses as a discrete part of their proposal.

This NEPA strategy has three major elements. The first involves preparation of a comparative programmatic environmental impact analysis, based on information provided by the offerors and supplemented by DOE, as necessary. This environmental analysis ensures that relevant environmental consequences of the CCT Program and reasonable programmatic alternatives are evaluated in the selection process. The second element involves preparation of a pre-selection project specific environmental review. The third element provides for preparation by DOE of site-specific documents for each project selected for financial assistance under the PON.

No funds from the CCT Program will be provided for detailed design, construction, operation and/or dismantlement until the third element of the NEPA process has been successfully completed. In addition, each cooperative agreement will require an environmental monitoring plan to ensure that significant site- and technology-specific environmental data are collected and disseminated.

Selection Decision

After considering the evaluation criteria, the program policy factors, and the NEPA strategy as stated in the PON, I have selected proposals from the following offerors, listed in alphabetical order, as best furthering the goals and objectives of this PON:

American Electric Power Service Corporation
Babcock & Wilcox
Coal Tech Corp. (Marion, Pennsylvania)
Energy & Environmental Research Corporation
Energy International, Incorporated
General Electric Company
Ohio Ontario Clean Fuels, Incorporated
The M.W. Kellogg Company
Weirton Steel Corporation

A brief description of each of the selected projects follows:

1. American Electric Power Service Corporation

The American Electric Power Service Corporation (AEPSC), on behalf of the Ohio Power Company, will construct and operate a 70MWe Pressurized Fluidized Bed Combustion (PFBC) Combined Cycle Demonstration Plant in Brilliant, Ohio. The project will utilize technology developed by ASEA-PFB.

The combined cycle plant will operate at 1580° F and a pressure of 12 atmospheres with off-gases expanded through an ASEA STAL GT120 gas turbine with a steam turbine bottoming cycle. The demonstration plant will be a retrofit of a moth-balled coal-fired power plant and will utilize the existing steam turbine and other site utilities.

2. Babcock & Wilcox

The two part project to be undertaken by the applicant is for the development of retrofit acid rain precursor control technologies. The first part is an extension of ongoing Limestone Injection Multistage Burner (LIMB) testing. Babcock and Wilcox is currently conducting the full-scale demonstration of the LIMB technology on a 105-MWe wall-fired utility boiler in a project co-sponsored by the U.S. Environmental Protection Agency (EPA) and the State of Ohio at Ohio Edison's Edgewater Station in Lorain, Ohio. The objectives of this project are to demonstrate NOx and SO_2 emissions reductions on the order of 50-60 percent at a capital cost at least $100 per kilowatt (kw) less than wet scrubbers. As a result of funding limitations of the existing EPA contract, testing currently is restricted to one sorbent and one coal. The results of the project proposed here will broaden the applicability of the LIMB technology by extending the number and types of coals and sorbents to be evaluated.

The second part of the project is to evaluate the Conoco "Coolside" process for SO_2 control. This process involves dry sorbent injection/humidification technology downstream of the boiler. The "Coolside" technology has been tested in a 1 MWe field test at Dupont's Martinsville plant. The proposed demonstration will also be done at the Edgewater Station and provide a side-by-side comparison with LIMB.

3. Coal Tech Corp. (Marion, Pennsylvania)

This proposed project is for a 1000 hour test to demonstrate the performance of an advanced, air-cooled, cyclone combustor with dry pulverized coal. Two Pennsylvania bituminous coals, containing 2 percent and 3 to 4 percent sulfur, and one Utah sub-bituminous coal, containing 0.5 percent sulfur, will be combusted to demonstrate that this advanced combustor is capable of burning a variety of United States' coals in an environmentally acceptable manner. The technical performance objectives of the proposed project are to demonstrate: (1) 90 to 95 percent coal ash retention in the combustor (and subsequent rejection), (2) NOx reductions to 100 ppm or less, (3) SO_2 emission reductions of 70 to 90 percent, and (4) combustor durability and flexibility.

The combustor can be adapted to new as well as retrofit boilers; it can be used for converting oil and gas designed boilers to coal; and it has industrial and utility applications.

The Coal Tech Corp. is now constructing a 30 Million BTU/hr (1 ton/hr) combustor which is nearing completion. The proposed demonstration project will be conducted at the Keeler Boiler Company/Dorr Oliver site in, Williamsport, Pennsylvania, where a 23 Million Btu/hr D-tube package boiler designed for oil is available. The 27 month in duration demonstration project includes the 1,000 hours of testing.

4. Energy and Environmental Research Corporation

The Energy and Environmental Research Corporation intends to demonstrate a combination of gas reburning and sorbent injection for the control of SO_2 and NOx emissions from existing coal-fired boilers. Program goals are 60 percent NOx control and 50 percent SO_2 control. Gas reburning is achieved by injection of natural gas (10 to 20 percent of the total fuel input) above the normal furnace heat release zone to produce an oxygen deficient region in the upper furnace (reburning zone). Burnout air is introduced above the reburning zone to complete the fuel combustion. A portion of the NOx produced in the main heat release zone is decomposed to molecular nitrogen in the reburning zone. Since the reburning fuel contains no sulfur, SO_2 emissions are reduced in proportion to the amount of gas fired. Additional SO_2 emission reductions are obtained by injection of calcium based sorbents either with the burnout air or downstream between the air preheater and the electrostatic precipitator.

Three host sites have been selected representing the three major firing configurations currently employed. These are tangential (Hennepin, Illinois site), wall fired (Bartonville, Illinois site), and cyclone (Springfield, Illinois site). Boiler sizes are 80 MWe, 117 MWe, and 40 MWe, respectively. A 48-month program is proposed with a 60-month period required if phase overlay is omitted.

5. Energy International, Inc.

This project involves a proof-of-concept/pilot demonstration of the underground coal gasification technology applied to the steeply dipping bed subbituminous coal deposits of Wyoming. The pilot demonstration unit will be at the same general location (Rawlins, Wyoming) as previous tests and will operate for 180 days, gasify 36,000 tons of coal, and produce up to 2000-4000 barrels of middle distillate liquids using a fixed bed indirect liquefaction technology. The demonstration represents one module of a commercial plant.

6. General Electric Company

This project will use an integrated coal gasification, steam-injected gas turbine power plant to demonstrate the feasibility of simplified gasification systems for commercial coal-to-electricity applications. The simplified system is configured to reduce components in each of the major subsystems: gasification, gas cleanup, and gas turbine power generation system, while retaining commercial hardware and design philosophy for many of the subsystem components.

The technology uses an air-blown moving bed gasifier, high temperature sulfur removal technology, hot cyclones, and the "LM" series (aircraft derivative) gas turbine/generator package. Key elements are the high-temperature gas cleanup systems which can allow significant reduction to the contaminant levels without degradation of plant efficiency. The system will be demonstrated at different sizes at the two site locations -- a 5 MW plant in Dunkirk, New York, of the Niagara Mohawk Power Corporation and a 50 MW General Electric plant in Evendale, Ohio.

7. Ohio-Ontario Clean Fuels Inc.

This project is for a prototype commercial coal/oil co-processing plant to be located in Warren, Ohio. This plant will convert high sulfur, high nitrogen, Ohio bituminous coal and poor-quality petroleum residuum to produce clean liquid fuels. The process to be utilized in the project is Coal/Oil Co-Processing, utilizing HRI Inc.'s proprietary ebullated-bed reactor technology.

In this process clean liquid fuels are produced from coal, petroleum residuum, and natural gas. The ebullated bed H-oil process has been operated commercially. Coal is blended with residual oil in the process and both are simultaneously converted to clean distillate fuels. A "typical" C4-975 degrees F distillate fuel will contain 0.1 percent sulfur and 0.2 percent nitrogen. The prototype plant will process 800 tons per day of coal, plus residual sufficient to yield 11,750 barrels per day of distillate product.

8. The M.W. Kellogg Company

The applicant will demonstrate an advanced integrated coal gasification combined cycle (IGCC) system. The project, to be located at Cairnbrook, Pennsylvania, will feature a Kellogg-Rust-Westinghouse (KRW) ash agglomerating fluidized bed gasification process using in-bed desulfurization with advanced "hot gas cleanup" for particulate and sulfur control, and a General Electric MS6001 gas turbine combined cycle power system. One such KRW gasifier operating in the air-blown mode, with in-bed desulfurization and hot gas clean-up technology, will convert 485 tons per day of bituminous coal into a low-BTU fuel gas for use in an advanced combustion turbine generator, coupled to a heat recovery steam generator. The steam generated from the combustion turbine exhaust and from the gasifier product gas heat recovery will be fed to a steam turbine generator.

The nominal 60 Megawatt (MW) demonstration project will feature a hot gas cleanup system which delivers fuel gas at 1000° F - 1200° F to the combustion turbine, thus avoiding costly inefficient low temperature cleanup processes. This is made possible by the use of in-bed desulfurization and a hot-sulfur-removal polishing step which uses a zinc ferrite sorbent bed. Particles will be removed by the use of a sintered metal filter.

The system, if demonstrated as proposed, would be highly efficient with heat rates around 7800 BTU/KWhr. Various sizes of commercial plants can be configured by using the 60 MW module that will be demonstrated in the overall system. Other applications for the system are cogeneration and retrofit of combustion turbines and gas fired combined cycles.

9. Weirton Steel Corporation

This project will involve a demonstration of the Kohle Reduction (KR) process. This process, which was developed by Korf Engineering (a West German Company), replaces the two-step coke oven/blast furnace approach to producing pig iron from iron ore and metallurgical coal with an integrated two component oxygen-blown blast furnace system capable of operation on a variety of U.S. coals. The system consists of an upper "reduction shaft" and a lower "melter-gasifier" component. Iron ore, along with an appropriate flux (e.g., limestone), is fed into the top of the reduction shaft where it is reduced to sponge iron by the off-gas from the lower melter-gasifier section. The lower section is an oxygen-blown fluidized bed coal gasifier. In this section the sponge iron is melted and the resulting pig iron and slag are separated and tapped as in a blast furnace. The low/medium-BTU, sulfur-free off-gases from the process (sulfur is captured by the limestone and remains in the slag) is scrubbed to remove particulates and is available for site use.

The proposed project calls for the design and construction of a 330,000 ton (iron) per year demonstration plant at the Weirton Steel plant in Weirton, West Virginia. The plant is to operate on a variety of U.S. feedstocks. The existence of a plant of the same technology and size in South Africa, to be completed in late 1987, could offer an alternative approach to obtaining the benchmark commercialization data; however this South African facility would not provide all of the data needed for U.S. commercial decisions, including information regarding design and operations keyed to U.S. environmental regulations and using raw materials that are indigenous to the U.S. (e.g. coals, iron, and limestone).

Selection Rationale

In making my selection decision, I first considered the Board's evaluation of the Technical proposal of each offeror since the PON stated the Technical proposal was of significantly greater importance than the Business and Management proposal. I then considered the Board's evaluation of the Business and Management and Cost proposals, bearing in mind that the PON stated that cost is minimal. In reviewing the Board's findings, I found the Board's evaluation to be thorough and a reasonable basis upon which to make a selection. I then applied the Program Policy factors and the NEPA Strategy to select the group of projects that would best satisfy the CCT Program goals and objectives.

The nine projects I have selected received the highest overall rankings by the Board for projects employing similar methods, technical approaches, and applications. My use of the program policy factors did not affect the relative rankings of the projects proposed.

My application of the first and second program policy factors (i.e., the desirability of selecting for support a group of projects that represent a diversity of methods, technical approaches or applications and the desirability of selecting for support a group of projects that would ensure a broad cross section of the U.S. Coal resource base is utilized, both now and in the future) affected the selection process in two ways.

First, two offerors proposed to demonstrate technologies that are capable of using the same coals, are proposed for the same market applications, and involve virtually identical technical approaches and methods. Application of the program policy factors precludes selection of both projects. In my judgment, the proposal selected represents the best overall project. This judgment is consistent with the views presented by the Board, and is based on a personal review of the technical, business management, and cost sections of the two proposals and an application of the relative weights assigned to each of these sections under the PON.

In the second instance, I included in my selection the proposal of Energy International, Inc., since it is the only proposal using the technical approach of an underground coal gasification technology integrated with indirect liquefaction for use on steeply-dipping bed coal seams. As such, assuming adequate water can be made available, it is the only method for efficiently and effectively using coals from steeply-dipping seams, thus, providing access to a very large coal resource base.

In considering the third program policy factor, I conclude that the group of projects selected represents a good balance between the goals of expanding the use of coal and minimizing environmental impacts.

NEPA Strategy

As previously indicated, an overall strategy for compliance with NEPA has been developed for the CCT Program. Consistent with the pre-selection aspects of the strategy (PON Sections III.27.1 and III.27.2), environmental analyses and other environmental information related to the demonstration projects proposed in response to the PON and to the anticipated environmental impacts of the technologies in their commercial applications were provided to and considered by me, to ensure that the relevant environmental consequences of reasonable alternatives were evaluated in the selection process.

The first analysis, Pre-Selection Programmatic Environmental Impact Analysis, was performed to enable a comparison to be made between (1) the projected environmental emissions in the U.S., and regionally within the U.S., assuming no new technologies and (2) the projected emissions assuming each proposed project that passed preliminary evaluation was commercialized and achieved the market penetration estimated by the offerors. This analysis also includes, in qualitative terms, a discussion of the environmental characteristics of the clean coal technologies, a discussion of unresolved environmental issues, areas where important environmental information is incomplete or unavailable, and tradeoffs between short-term and long-term effects, to the maximum extent possible. The discussion included air quality, water quality, and solid waste disposal issues that a fully commercialized technology may ameliorate or aggravate. The key air quality issues dealt with included criteria pollutant problems, acid rain and, to a lesser extent, visibility impairment and global warming due to increasing concentrations of carbon dioxide. This analysis also contained the strengths and weaknesses of each proposal relative to the environmental criterion addressing the projected commercialization of the proposed technology.

The second analysis, Pre-Selection Project-Specific Environmental Review, focused on project-specific environmental issues. This analysis contained, for each proposed project that passed preliminary evaluation, a discussion of the site-specific environmental, health, safety, and socio-economic issues associated with the demonstration project. It included, to the maximum extent possible, a discussion of alternative sites and/or processes reasonably available to the offeror, a discussion of the environmental impacts of the proposed project and practical mitigating measures, and a list of permits, to the extent known, that must be obtained to implement the proposal. It also contained the strengths and weaknesses of each proposal relative to the demonstration project environmental and site-related criterion.

Based upon the information provided, I have reached the following judgments:

1. None of the selected projects in their commercial applications are judged to have unacceptable adverse environmental consequences relative to the environmental baseline for the year 2010. In every case, sulfur dioxide and nitrogen oxides emissions and hazardous wastes for the commercial technologies are projected to remain approximately the same or decline. With the exception of one case where water use may increase slightly, water use also is projected to remain approximately the same or decline. Particulate matter emissions and total suspended solid (TSS) releases are projected to remain approximately the same or decline, except in one case where particulate matter and one case where TSS are projected to increase as much as 5%. In seven cases, non-hazardous solid wastes could increase (in no case more than 4%) as a direct result of the SO_2 reduction achieved. However, the potential problems were deemed to be manageable.

2. The group of projects selected provide a good balance between minimizing environmental impacts and expanding the use of coal.

Only one non-selected proposal was considered a reasonable alternative to the projects selected for award. This determination was based on the fact that the non-selected project was proposed for the same application and received a roughly comparable rating to one of the projects selected for award. Both the selected and reasonable alternative projects received very high ratings on each of the environmental health, safety, and socio-economic (EHSS) evaluation criteria. The reasonable alternative project received a slightly higher rating on each of these EHSS criteria. Since, however, the differences between the scores were minor, I have determined that the environmental consequences of the two projects appear to be comparable. After consideration of all the evaluation criteria and their relative importance, the project selected for award was judged to be a better project than the reasonable alternative. Application of the program policy factors precluded selection of both projects, since they constitute virtually identical technical approaches and methods, are capable of using the same coals, and are proposed for the same market applications.

In accordance with Section III.27.3 of the PON, offerors awarded cooperative agreements under this PON will be required to submit additional environmental information to DOE which will be used as the basis for site-specific NEPA documents to be prepared by DOE. No funds from the CCT Program will be provided for detailed design, construction, operation and/or dismantlement until this part of the NEPA process has been successfully completed.

REPORTS TO CONGRESS

In accordance with Pub. L. No. 99-190 and its legislative history, additional information regarding the selected projects will be provided in at least two reports to be submitted to the Congress. The first report, which DOE intends to submit within 30 days, will be a comprehensive report on all proposals received in response to the PON. The second report or groups of reports, to be submitted at least 30 calendar days prior to the execution of any cooperative agreement to be entered into as a result of this PON, will consist of a full and comprehensive report on each of the projects selected, including the facts and circumstances relied upon in support of the proposed projects.

CONCLUSION

In summary, after considering the evaluation criteria, the program policy factors, and the NEPA strategy provided in the PON, I believe that the selected group of projects best achieve the CCT Program goals and objectives embodied in the PON. If, for any reason a cooperative agreement is not actually awarded to any of the proposers identified above, I will apply the evaluation criteria and program policy factors to the remaining proposals to select an additional project or projects.

Donald L. Bauer

Donald L. Bauer
Acting Assistant Secretary
for Fossil Energy

July 24, 1986
Date

Addendum to the Statement Providing for the Selection of Proposals for the Demonstration of Clean Coal Technologies Program Opportunity Notice DE-PS01-86FE60966

In fairness to those applicants that have no possibility of selection in the future, I have decided to eliminate 15 ~~firms~~ PROPOSALS DB from further consideration under the Clean Coal Technology (CCT) Program Opportunity Notice. Those applicants will be notified by letter that they have been eliminated from further consideration.

In the event that, for any reason, a cooperative agreement is not actually awarded to any of the selected proposers identified in the Selection Statement for the CCT Program of July 24, 1986, I will apply the evaluation criteria and program policy factors to the following remaining proposers, listed in alphabetical order, to select an additional project or projects:

City of Tallahassee
Colorado - UTE Electric Association INC DB
Combustion Engineering, Inc. DB
Consolidat~~ed~~ion Coal Company and Foster Wheeler
  Power Systems, Inc.
McDonnell Douglas Energy Systems, Inc.
Minnesota Department of Natural Resources
Southwestern Public Service Company
Tennessee Valley Authority (2 proposals)
TRW, Inc.
United Coal Company
Western Energy Company DB
Westinghouse Electric ~~Power Company~~ CORPORATION
Wisconsin Electric Power Company

Donald L. Bauer
Donald L. Bauer
Acting Assistant Secretary
  for Fossil Energy

July 25, 1986
Date

Mr. Fuqua. Thank you, Mr. Bauer.

As I mentioned in my opening statement, and I don't think you covered it in yours, is, the policy that you may have for negotiating the contracts, is it going to be open-ended or is it going to be a time frame that you hope to have this completed? Because many of those who were not selected in the initial nine I'm sure are anxious to find out how long they need to keep their teams together, and that costs them money. Is there going to be some time frame that, or milestone markers along the way that people will understand?

Mr. Bauer. OK. Mr. Chairman, first of all, I say it is open-ended. Negotiations——

Mr. Fuqua. Open-ended means it could go on for 5 years or more.

Mr. Bauer. No, that's totally unacceptable. The points are, first of all, it's the No. 1 priority at Morgantown and Pittsburgh Energy Technology Centers. The No. 1 thing that they have on their platter is to do those detailed negotiations and arrive at a negotiated agreement, get that agreement into headquarters for final review, put the report together, have it lie before Congress for 30 days. But we haven't set a specific time that you've got to complete negotiations with firm A, B, C, because I think if we set a timetable there could be—we would be compromising our position as well as maybe the taxpayers. Because in each one of these in a response to the solicitation they presented to us exceptions, deviations and conditions on the cooperative agreement. They specified all these. So in the detailed negotiations one has to address all of those conditions that they gave to us.

But that's not to say that we are not going ahead and moving very fast. Some of those cooperative agreements I see could be signed before the end of the calendar year. Other ones are very complicated, and very expensive on the part of both parties. And when one looks at they have to deliver a financing plan and provide additional data to us at this time, because the schedule we were on, we didn't have time to have orals with these people.

So I think our best posture is not to set a specific time but keep it as No. 1 priority and get on with it. And also, since we are negotiating at two different centers and there are nine different projects, they are all different, one has to be concerned also about consistency relative to the financial assistance.

Now, Mr. Chairman, I think you raised another point about the other people waiting in the event that we don't reach successful negotiations with any of the people that we have selected for negotiation. It is my understanding, Mr. Chairman, that their current proposals are valid through the end of this calendar year. When I did the selection, the Department wrote those people that were in the second grouping and asked them to come back to us and express a willingness to keep open their proposal in the event that we don't reach successful negotiations with the selected firms.

It is my understanding that some of those people have come back and expressed their willingness. And not all of them have, but they have between now and the end of the year to do that expression of interest because their proposal is valid through the end of this calendar year.

Mr. FUQUA. Well, I realize you can't be pinned down to a hard, fast date, and I am not trying to do that. But it would seem that, if you say that some may be completed by the end of this year, calendar year, those that are not completed by that time would it be 90 days after that or 120 days or 6 months? Is there some guideline, not that you have to rigidly conform to it, but at least that you can say we hope to have this completed by April 1st or something of that——

Mr. BAUER. I think I would go along with that, Mr. Chairman, because——

Mr. FUQUA. When you say open-ended——

Mr. BAUER. I am not trying to evade your point because——

Mr. FUQUA. No, I realize that.

Mr. BAUER [continuing]. There are certain things that are in that SEB process and several positions taken by proposers that are going to take some time to negotiate. And some of them are very sensitive, and other ones are bound by financial assistance regulations.

I would say that I have said it's a high priority on our part. I would say to those people, it should be a very high priority on their part to provide the data and sit down to the table on detailed negotiations. I would be very pleased if all of the nine came to fruition and those reports accompanying all of those nine were here on or before April 1 as you have said.

I would say that to me, considering what I know, Mr. Chairman, that would be a responsible——

Mr. FUQUA. Well, most all of them have their financing all arranged, do they not? When they submit their proposal, doesn't that include the financial——

Mr. BAUER. They identify their percentage of cost sharing that they propose.

Mr. FUQUA. Yes.

Mr. BAUER. They identify their sources. But upon selection, they are to provide to us a detailed financing plan identifying those sources by commitment. For example, several of the firms identified outside financial assistance. For example, one of them had GRI, the State of Ohio, and other entities. Those people have to sit down with the States or that entity and lock up that money when they come to the table say I have the firm commitment, I am going to get the money on such and such a date, and that is part of the negotiations, so that's got to happen also.

Mr. FUQUA. Well, now suppose an award has been agreed to. Then it is submitted to Congress for 30 days. When would they expect to receive their first installment?

Mr. BAUER. If the 30 days expired——

Mr. FUQUA. Assuming everything goes fine?

Mr. BAUER. Everything is good, OK. It would depend upon what the—if the proposer had his letter of credit and everything was in place, he would start getting his, the government's financial assistance I would say at that time. He submits a voucher at the end of that month for his, the—for recoupment or for the government to put up its share of the negotiated agreement.

Let's say it was a 60–40 deal for which he was putting up 60 percent and we were putting up 40 percent. He would submit a voucher and which at the end of that month it would go through audit and review, which shouldn't take very long, and then he would receive payment.

Mr. FUQUA. You mentioned recoupment, and that as not required by the congressional act. How did that get in there?

Mr. BAUER. I think the legislative provisions of 99-190 provided the authority for the Secretary of Energy to recoup revenues from projects such as these. It was our—in taking that, administrative provisions what we said was that we are going to provide financial assistance—this is not a loan program, it's a financial assistance program—and structured the solicitation such that there was a recoupment provision.

We need to keep in mind that under the recoupment the—he pays us back out of one or two sources, but if there is no profit or no net revenues, there is no recoupment of the financial assistance provided by the Federal Government.

Mr. FUQUA. Well, did you consider whether it should be based on gross revenue or net revenue?

Mr. BAUER. At the time, Mr. Chairman, we were putting the draft solicitation and we looked at, OK, there is an administrative provision which gives the authority for the recoupment. And we said where along the line or how best to structure that? And we looked at recoupment on a gross revenue basis during the operation period, we looked at it on a net basis after the operation period is over as specified in the agreed upon cooperative agreement, and we also looked at recoupment under licensing, sale, transfer, or whatever, of the technology for a period of up to 20 years.

In the finalization of that solicitation and also in testimony before subcommittees and committees of Congress there came down that the recoupment would be from profits. Well, there's only one way that you can have recoupment from profits, and that is, that you are running a facility and that costs so much, and if you have revenues in excess of that that could conceivably—you put the tag on that and say that's profits. So it was on the basis that if it was profitable after the end of the operating period, then and only then would be share the recoupment commensurate with the cost-shared agreement that we signed up for. Let's say it was a 60-40 deal. We would share those profits in accordance with that cost-sharing agreement up to the point we recovered our initial financial assistance without interest.

Mr. FUQUA. What—you had 51 proposals. I think you made—about 9 were selected and there's 14 on a standby list. What's the significance or the implications of being on that standby list?

Mr. BAUER. Well, Mr. Chairman, the law said there's $400 million that is hereby appropriated and is to be expended solely for the purpose of a Clean Coal Technology Program. So it says "and expended." That's a clear message and a signal.

Sometimes in negotiations one is unable to reach an agreement because there is a government regulation, there is no way you can get around it in a waiver, or maybe the proposer is insisting on something. So what we said is we had 51 proposals, there were 9 that were disqualified, and we looked at the 9 we selected and said: in the event any of them fail, and considering the priority of this program—the acid rain, the issue of making maximum use of our resource, providing assistance to help the marketplace penetrate and use the money to forward the technology—we said, isn't it better to have these people that in the event negotiations fail that you can go to right away.

Go to right away, though, I put a caveat on by—that means that I'm going to wait till we either have negotiated agreements with all nine or not at all. And at the end of the completion of the negotiations of those nine, if one or more fall out, at that time I will deselect those two—two or three, whatever the number may be. I will deselect those people, go back to the evaluation criteria, apply the program policy factors and select one or more projects. And it avoids a resolicitation and a loss of time going back out to expend the money which Congress said: here, this is high priority, get on with the job.

Mr. FUQUA. I don't mean to prolong this. I know we have other members who wish to ask questions. But would—to start with, the list was in alphabetical order. Would you reevaluate all 14 and then pick the 10th one out of that, and then if that was successful and you had some more money left, then you would reevaluate all the others and pick the 11th one? Is that the procedure that you would follow?

Mr. BAUER. The fact that they are in there in alphabetical order, that is a normal practice; it has nothing to do with how they came out on the ratings. And what I would do would, depending on who dropped out because of unsuccessful negotiations, because the program policy factors said you look at all coals, all markets, and all technologies, and the person that we were unable to reach a successful agreement with, it is depending on how much was beside his name for financial assistance.

So, it's a total balancing, and I would think that one could go back to the evaluation criteria, go back to the program policy factors, revisit the NEPA strategy, and still have available to me the members of the Source Evaluation Board—they are not discharged, they still have this responsibility—I think I could do that in 30 days or less.

Mr. FUQUA. Then I assume that it will be evaluated to death. It seems if you have to go back and re—they would have evaluated them to begin with.

Mr. BAUER. Yes——

Mr. FUQUA. It would seem they would have some pecking order that they thought that this project should be up at the top of the heap rather than some other project.

Mr. BAUER. The Source Evaluation Board is not going to go back and reevaluate. We'll take the results of the evaluation that we have and go back through it.

Mr. FUQUA. Thank you.

Mrs. Schneider.

Mrs. SCHNEIDER. Mr. Bauer, I have a number of questions that relate to your decisionmaking criteria.

Mr. BAUER. OK.

Mrs. SCHNEIDER. Sometime ago the administration made it very clear that they identify the Clean Coal Technology Program as one that we would implement in order to control acid rain. And earlier this year, Lee Thomas, the head of the Environmental Protection Agency, appeared before the Senate, and so I have this exact I would like to quote some of this remarks. He said, "The potential need to control sulfur oxides and nitrogen oxides from existing sources makes retrofits the most important application technology."

Would you agree with that assessment?

Mr. **Bauer**. I think I was at one of those hearings with Mr. Thomas on clean coal. I agree with the statement he made. The point is——

Mrs. **Schneider**. That retrofits are a high priority?

Mr. **Bauer**. They are of a priority.

Mrs. **Schneider**. Not a high priority?

Mr. **Bauer**. I'm saying that under the Clean Coal Program, and he's going to the Envoys' report, which is the high—use of high sulfur coal, retrofittable technologies, utility applications; and also on the Envoys, you are really going for capacity reduction of the SO_2 and the NO_X at the most economical means. The clean coal—so that's a very specific objective and goal and what you're trying to do.

And the Clean Coal Program was all coals, all markets, and all technologies, and it included that very specifically. So the fact that when we did the selection that five of the projects selected are retrofittable or have the retrofittable potential, my point is yes, it is a priority; and in selecting that was, in retrospect, looking at the selections, that is accounted for.

Mrs. **Schneider**. So you say that five out of the nine are retrofittable?

Mr. **Bauer**. Yes.

Mrs. **Schneider**. Have you worked with EPA to develop an analysis of the nine proposals based on the Envoys' report and the criteria that has been delineated there?

Mr. **Bauer**. I have not worked with EPA. I committed in one of my testimonies this year, although not required congressionally by law, I committed to the delivery of a report which does an analysis and a comparison of these nine against the Envoys' criteria. And I am here today to say that it is a very high priority for Mr. Jack Siegel, to my right, and I've asked for that to be delivered as soon as possible; and he's saying now he thinks he can make it before the end of the fiscal year.

Mrs. **Schneider**. Well, Mr. Bauer, it seems to me that EPA for sometime now has had the leadership role in reducing emissions which lead to acid rain. Their Acid Rain Division has appeared before this committee on numerous occasions, and certainly they have significant expertise in this area. But you are saying that you have not consulted with them insofar as criteria is concerned that would match the Envoys' report——

Mr. **Bauer**. I have not——

Mrs. **Schneider** [continuing]. As yet?

Mr. **Bauer**. We have not as yet. I would think it would not be a wise management decision or a prudent decision to go ahead and do something like this without interface and coordination with EPA, and I'm going to do this.

Mrs. **Schneider**. Well, my question is, why has that not been done prior to the selection of those nine sites given the role that EPA will ultimately play? For example, let us say that you have chosen those nine particular programs. EPA does their assessment according to the guidelines established in the Envoys' report, and the EPA says, for example, that they don't meet that criteria, to be more exact. What would you do then? We are wasting once again more time and more money in going back to the drawing boards and making the selections, and also building false hopes among those nine people who have been told that they are part of the program.

Mr. **Bauer**. OK. To that, EPA was a member of the Source Evaluation Board. They had membership there. And in the selection and—your points are well taken, but the criteria and what was in the solicitation and the PON, we were bound by those criteria. EPA was involved and had a voice, and their voice was heard.

Mrs. **Schneider**. Well, Mr. Bauer, I choose to differ with you. To be specific, the EPA has provided me with a staff analysis of the DOE selections in the light of the Lewis-Davis criteria. And this analysis shows that the nine projects selected, one met the criteria, two may meet the criteria, and six clearly did not. I think that is even more startling is EPA's acknowledgement that neither it nor DOE has formally analyzed the selected projects to determine whether they comply with the Lewis-Davis criteria.

Now you are talking about doing that several weeks in the future, I am just saying it seems to me that the decisionmaking process is totally reversed. And given the input of EPA on a staff level to the Administrator——

Mr. **Bauer**. Yes.

Mrs. **Schneider** [continuing]. It seems like you are going to have to go back to the drawing board, waste more money, waste more time.

Mr. **Bauer**. I'm familiar with that charge that they used in their presentation to Administrator Thomas. And at the point that they did that, they were briefing the administrator and that was their own, the staff's subjective analysis of their assessment of compliance with the Lewis-Davis criteria. At that point neither one of us had really analyzed formally the projects selected by us to the extent that they satisfy that.

I guess I'm disturbed, Miss Congresswoman, by the point that it may have to go back to the drawing boards. The Department of Energy was given this program to execute, followed all the rules, the criteria given to us by Congress, and had EPA involvement. It was for all coals, all markets and all technologies. It wasn't specifically just for the Envoys. And in selecting that and following the congressionally mandated criteria, in looking at that, that was taken into. The fact that now we look at it and we say, "yes, of the nine some of them have retrofittable technology, if you would—the solicitation wasn't just for retrofittable technology, it was for any technology."

Mrs. **Schneider**. I understand. But might I interject something right now?

Mr. **Bauer**. Yes.

Mrs. SCHNEIDER. When one looks at the big picture of where we are in terms of retrofit, the report notes that there would be significant reductions in acid rain and it would definitely require the development of retrofit technologies because here in the United States we are not replacing older facilities as quickly as we originally thought that we would. Many of the coal-fired plants that we have now were thought to have a useful life of 35 to 40 years, but now we are finding out that they're lasting for 60 or more years. And so as a result of that comprehensive assessment, we now understand that this postpones the rate at which new sources will replace existing sources. Therefore that makes new source performance standards, which you have been working on, a less effective way of reducing overall emissions.

Now it concerns me a great deal when we are looking, you know, at our options and the need for us to move along with this rapidly.

Mr. BAUER. EPA is also doing control technology work. I believe they have a solicitation out, the proposals are in, and they are about to make selections on that. And they are proposing a new program which is for control technology and it is retrofittable.

Mrs. SCHNEIDER. Is that just one project, or is that——

Mr. BAUER. They have their LIMB project, which is tangentially fired? No, wall-fired. Jack?

Mrs. SCHNEIDER. Well, I don't want us to get into so much detail that we get off the point.

Mr. BAUER. But all I'm saying is they have an ongoing LIMB program. They went out with a solicitation. Their proposals are in, for control technology, and they will be making selections soon on that one. So in looking at it in total balance I believe that the business of retrofit will be taken into account when one looks at all the projects that are available.

Mr. FUQUA. If the gentlelady would yield?

Mrs. SCHNEIDER. Thank you, Mr. Chairman. Yes.

Mr. FUQUA. We inquired of EPA about this information and they refused to provide it to the committee. If the gentlelady would not object, I would like to ask unanimous consent to put it in the record at this point.

Mrs. SCHNEIDER. Yes, Mr. Chairman, I would be happy to submit it for the record.

Mr. FUQUA. So, without objection, so ordered.

[The information follows:]

EPA ANALYSIS OF DOE CLEAN COAL TECHNOLOGY SELECTIONS

° AVAILABLE INFORMATION WAS ANALYZED BASED ON 3 CRITERIA
- IS THE TECHNOLOGY SUITABLE FOR RETROFIT ON EXISTING UTILITY OR INDUSTRIAL BOILERS
- IS THE REMOVAL EFFICIENCY GREATER THAN 70% (BASED ON % SO_2 + 1/4 (% NO_x))
- DOES IT COST LESS THAN FLUE GAS DESULFURIZATION

TECHNOLOGY	APLICABILITY TO LEWIS-DAVIS CRITERIA			
	HIGH REMOVAL EFFICIENCY	COST LESS THAN FGD	RETROFIT EASE	OVERALL
LIMB PLUS DUCT INJECTION	YES	YES	HIGH	YES
GAS REBURNING WITH SORBENT INJECTION	POSSIBLE	YES	HIGH	POSSIBLE
SLAGGING COMBUSTOR WITH SORBENT INJECTION	POSSIBLE	YES	POSSIBLE	POSSIBLE
PFBC COMBINED CYCLE RETROFIT	YES	NO	LOW	NO
UNDERGROUND COAL GASIFICATION	-	-	NO	NO
COAL GASIFICATION/GAS TURBINE	YES	POSSIBLE	NO	NO
COAL LIQUEFACTION	-	-	NO	NO
GASIFICATION/COMBINED CYCLE	YES	NO	LOW	NO
DIRECT IRON ORE REDUCTION	-	-	NO	NO

IN THE PROCESS OF BRIEFING ADMINISTRATOR LEE THOMAS ON RETROFIT TECHNOLOGIES APPLICABLE TO ACID RAIN CONTROL PROGRAMS, A VIEW GRAPH WAS PREPARED BY EPA STAFF RELATING TO THEIR UNDERSTANDING OF THE PROJECTS SELECTED UNDER THE CLEAN COAL TECHNOLOGY PROGRAM (CCT) TO SEVERAL OF THE CRITERIA PUT FORTH IN THE SPECIAL ENVOY'S REPORT. THE EVALUATION EMPLOYED IN PRODUCING THIS GRAPH WAS NOT A PART OF ANY REPORT, BUT WAS A CURSORY STAFF REVIEW OF THE QUESTION. IT SHOULD NOT BE CONSIDERED AS FORMAL AGENCY POSITION.

Mrs. SCHNEIDER. Well, Mr. Bauer, I still don't feel that my concerns have been resolved. And I think that as we struggle night and day to figure out how we are going to spend our hard-earned taxpayers' dollars as we are trying to grapple with Gramm-Rudman and as we look at our national energy policy and the complacency which currently exists about the price of energy, there is no question in my mind that DOE has got to hustle. And what you have got to really focus on is to provide us with the near term as quickly as possible, and clearly any retrofit programs are the ones that will have the most appropriate applicability given the time lines that we're looking at.

Mr. BAUER. I agree with you, Mrs. Schneider. And also I note with interest, and we are doing some homework now as a point to show that we're taking it seriously, that in the appropriations process both the House and the Senate are talking—have in there, if that bill ever goes to conference, for us to do statements of interest and informational proposals just for that very fact, which is high sulfur retrofittable technologies. And so we are doing some homework to get ready for that when we are directed to do that, rather than waiting; using our spare time that we got now to get ready for that.

Mrs. SCHNEIDER. Well, Mr. Bauer, I would very much appreciate it, and I think that my colleagues here, too, knowing the role that EPA has played in the acid rain program, that you work closely together from the outset and that you include the priority of the Envoys' report for retrofittable demonstration projects. And by doing so, I think that we can be more assured of the success of your programs.

Mr. BAUER. Thank you. Just one other point on the Bilateral Consultative Group with Canada.

Mrs. SCHNEIDER. Yes.

Mr. BAUER. Mr. Craig Potter and I were up to Canada, we were both on that Group and we are working very closely. It's just that the time—I share your views and I share your priorities and I got the message. It's just the time to do all of those things. And I feel good that, in looking at the nine, that there is retrofits in there or retrofit potential. It is not an easy analysis to do. I'll put the pressure on the people to have it done before the end of this fiscal year and we'll get that to all the subcommittees.

Mrs. SCHNEIDER. Well, I think——

Mr. BAUER. And we'll talk to EPA before the report comes out.

Mrs. SCHNEIDER. Good. Because we are all looking for action. We are very much concerned that we as a country have been criticized by not only our constituents but also by the Canadians and people around the world that we have been playing lip service to the control of acid rain, and I think that until you provide us with some hardcore, immediate retrofittable demonstration projects we're not really substantiating our words. So I'm hopeful that we can move along with this, these projects rapidly and appropriately. Thank you, Mr. Chairman.

Mr. BAUER. We will.

Mr. FUQUA. Thank you, Mrs. Schneider.

Mr. Cobey.

Mr. COBEY. Thank you, Mr. Chairman.

I've enjoyed this dialog and want to support the statements and concerns of the gentlelady from Rhode Island. I'm glad to hear that you're going to be moving in a direction of high level cooperation with EPA——

Mr. **Bauer**. Yes.

Mr. **Cobey** [continuing]. And putting the emphasis on retrofitting because I agree with the gentlelady that we need to get some immediate results. So I just stand in support of what she had to say, and glad to hear that you're going to cooperate with that.

Mr. **Bauer**. Always.

Mr. **Cobey**. Thank you, Mr. Chairman.

Mr. **Fuqua**. Mr. Packard.

Mr. **Packard**. Thank you, Mr. Chairman.

I apologize for not being able to hear all of your testimony, Mr. Bauer. But one question as a followup of the chairman's questions on recoupment.

Some Members of the Congress are concerned about recoupment, but have we had any expression from those that are bidding as to their concerns? What are their feelings about recoupment? Have we had any response from them?

Mr. **Bauer**. Mr. Packard, the concerns I think that we had was that before the solicitation we had a presolicitation conference and there were a lot of questions on the part of potential proposers at that time as how are you going to recoup? Is it on gross revenues? Is it on net revenues? When do I have to pay back? And how much do I get to keep? And when do you want it back? And what constitutes really recoupment?

After that we had the 51 proposals that came in, and out of that there was 39 that went into comprehensive evaluation. I don't recall, and there was a vast amount of data if you look at 51 proposals. I forget how high it was. But trying to recall, there wasn't any rejection of the recoupment provision. As we went out with the solicitation it had a model cooperative agreement in it. That will be the legal document that you sign. And I think there may have been one or two that took some kinds of exceptions to that. I don't recall what they were, but they were not that specific.

And furthermore, the number on the cost-sharing and the recoupment, if we look at the quality of the proposals that we had, I don't think there is any serious reservations on the recoupment. But they have to provide a detailed financing plan and a recoupment plan to us, and that's a part of the negotiations that's going on right now.

Mr. **Packard**. And the data that will be accumulated from the projects, will that be made available to the public or will there be some proprietary and business confidential concerns attached to it?

Mr. **Bauer**. Mr. Siegel?

Mr. **Siegel**. To the extent that we're able to provide information to the public, we intend to do that. We're going to maximize the public availability of information. In some cases we might expect that there might be business proprietary information, which you might expect as a result of the fact that these companies are putting up large amounts of their own money for these demonstration projects.

Mr. **Packard**. And how will the patent rights be addressed, and the proprietary rights?

Mr. **Bauer**. The issue of the patent rights and inventions and proprietary data is a matter that should be resolved this week between our headquarters general counsel and the general counsel of two of the ETC's that are negotiating that. When that is resolved I would be pleased to provide you whatever the results of that are.

Mr. **Packard**. Thank you, Mr. Bauer. And thank you, Mr. Chairman.

Mr. **Bauer**. Thank you, sir.

Mr. **Fuqua** Mr. Bauer, I have just one final question, and that is getting to the point of retrofits. Do you think by adding the recoupment requirements that you have reduced the quality of the type of proposals that have come in for retrofit?

Mr. **Bauer**. Not at all. The proposals that went through comprehensive evaluation and the—and you could break them down, it covered all those technologies and it covered everyone of the markets. And there was, I was trying to recall how many of those—I think there was like, out of the 51 if one looked at it there was like 16 which were applicable to the utility sector, which is the biggest user of coal. There was a larger retrofit potential, or either that or proposed. I don't think the recoupment served as a—where there was a chilling effect or caused not there to be more proposals than there was. I don't believe so. We're quite happy with the response.

Mr. **Fuqua**. Thank you. And we, because of time constraints we may have some questions that we would like to submit to you in writing. We would like, and if that's OK, we could do that.

Mr. **Bauer**. I would be pleased to answer any additional questions for the record in a timely manner.

Mr. **Fuqua**. Thank you very much.

[Answers to questions asked of Mr. Bauer by Mr. Fuqua and Mr. Sensenbrenner follow:]

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September 30, 1986

Donald L. Bauer, Acting Assistant
Secretary for Fossil Energy
U.S. Department of Energy
Washington, DC 20585

Dear Mr. Bauer:

Thank you for your excellent testimony before the Subcommittee on Energy Development and Applications on September 10, 1986. Enclosed are a number of questions that Members of the Subcommittee would like you to answer, in order to supplement the hearing record.

We would appreciate your responses to these questions by October 20, 1986. If you have any questions regarding this request, please contact Jack Dugan, Acting Staff Director of the Subcommittee, at (202) 225-4494.

Sincerely,

Don Fuqua

DON FUQUA
Chairman

DF/ld
Enclosure

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

Hearings to Assess Department of Energy's (DOE)
Clean Coal Technology Program

Conducted September 10, 1986

Additional Questions for Department of Energy

1. The FY 1987 Department of Interior appropriations reports contain language directing the DOE to begin preparing a second solicitation in the Clean Coal Technology program regarding retrofit technologies. If this provision becomes public law, is the Department ready to begin the solicitation process?

2. It appears reasonable to presume that all 14 projects currently on the standby list from the first solicitation have proposals of some significant merit. Will the definition of retrofit for the second solicitation be broad-based enough to allow those on the standby list to reapply under the retrofit provisions if they wish?

3. Please define the terms retrofit, repower and modification as used by the Department during the evaluation of the 51 proposals submitted.

4. Statements that were made on predicted performance of clean coal technologies generally cited percentage reduction in SO_x and NO_x. This does not specifically address the crucial question, viz., "Will the effluent level, using this system, satisfy emissions requirements?"

5. Reduction in BTU cost per emission reduction is usually a pass-along to the utility consumer via the fuel rider. The utility does not realize additional earnings from burning cheaper fuels and, in fact, usually must invest in capital plant to burn these fuels. Would you recommend that any sort of tax incentive, or other "carrot" be given to a utility to promote installation of such equipment?

6. DOE plans to have personnel from PETC and METC do the actual contract negotiations. Is there any guarantee that once the DOE General Counsel receives the agreements from the field offices that the awardees won't have to go through another set of negotiations?

7. Once the 30-day report has been accepted by the Congress, how long will it take before the awardees receive some funding from the Department?

8. How will payments be made? Lump sum, or through several equal allotments?

9. In your testimony, you mention that one of the agreements may be signed by the end of the year. Do you expect that negotiations will be completed with other projects within 90 days? 120 days?

10. Have additional staff been provided to METC, PETC and headquarters to carry out the awardee negotiating process?

    If not, are you expecting additional staff to be assigned in the near future?

    Without additional staff, do you believe that you can provide quality management of these projects similar to that provided for the Great Plains Project?

11. What effect do you anticipate that the Clean Coal Technology program will have on the current DOE program with regard to funding levels and personnel levels?

12. Could you point out the complementary relationship between certain projects or classes of projects and ongoing Fossil R&D activities?

13. If projects from the standby list of 14 are selected for negotiation, what will DOE require in terms of additional information from the selectees?

14. Once agreement has been reached between DOE and an awardee, is there a deadline to finish NEPA documentation and satisfy requirements?

15. What is the average time expected to be for receiving certification of environmental compliance for a project?

16. Are you satisfied with the degree to which the projects selected will reduce existing emissions through retrofit applications?

17. Although the Congress did not specifically address the retrofit issue, isn't it important to consider this approach so that we not only assure the public that new plants will be low in acid rain emissions, but that the existing level of emissions can be affected through encouraging early retirement of these very significant sources of SO_x and NO_x?

18. How will the RFP for retrofit-oriented projects recognize the potential effects of this recoupment disincentive?

19. Was the recoupment factor incorporated in project ratings, e.g., was a project which promised early government payback given more weight than a similar project which required much longer payback time for the government loan, all other factors being equal?

Department of Energy
Washington, DC 20585

October 29, 1986

Honorable Don Fuqua
Chairman, Committee on
  Science and Technology
United States House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

On September 10, 1986, Donald L. Bauer, Acting Assistant Secretary for Fossil Energy, appeared before the Science and Technology Subcommittee on Energy Development and Applications to discuss the Clean Coal Technology Program.

With your letter dated September 30, 1986, you submitted written questions for our response. Enclosed are the answers to those questions, which also have been sent to the Subcommittee staff.

If you have any questions, please have your staff call Danette Hughes or Cathy Hamilton on 252-4277. They will be happy to assist.

Sincerely,

Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosure

POST-HEARING QUESTIONS AND ANSWERS

Relating to the

SEPTEMBER 10, 1986, HEARING

Before the

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

of the

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

Witness: Donald L. Bauer
Acting Assistant Secretary for Fossil Energy

CLEAN COAL TECHNOLOGY

Question 1: The FY 1987 Department of Interior appropriations reports contain language directing the DOE to begin preparing a second solicitation in the Clean Coal Technology program regarding retrofit technologies. If this provision becomes public law, is the Department ready to begin the solicitation process?

Answer: The Clean Coal Technology portion of Public Law 99-500 provides that the Secretary of Energy shall, "No later than thirty days after the date of the enactment of this Act, publish in the Federal Register a notice" for informational proposals and statements of interest with regard to emerging clean coal technologies which are capable of retrofitting, repowering, or modernizing existing facilities. The Department is confident of its ability to comply with this time requirement.

CLEAN COAL TECHNOLOGY

Question 2:	It appears reasonable to presume that all 14 projects currently on the standby list from the first solicitation have proposals of some significant merit. Will the definition of retrofit for the second solicitation be broad-based enough to allow those on the standby list to reapply under the retrofit provisions if they wish?
Answer:	The Congressional guidance with regard to the second solicitation (i.e., statements of interest and informational proposals for projects employing emerging clean coal technologies which are capable of retrofitting, repowering, or modernizing existing facilities, as referred to in Public Law 99-500) provides, in the accompanying House Report No. 99-1005, that, "It is not the managers intent to consider projects which duplicate previous demonstrations." However, the Department does not plan to prohibit the 14 projects on the so-called "standby list" from responding if they meet the other requirements of the informational solicitation.

CLEAN COAL TECHNOLOGY

Question 3: Please define the terms retrofit, repower and modification as used by the Department during the evaluation of the 51 proposals submitted.

Answer: The Department assumes that the question is referring to the Program Opportunity Notice that was issued on February 17, 1986, in response to the provisions of Public Law No. 99-190. In accordance with that guidance, the Department stated that the PON was "open to both 'new' and 'retrofit' applications, whether intended to displace oil and natural gas or to utilize coal more cleanly, efficiently, and/or economically than presently available technology." The terms "repower" and "modification" are, to our knowledge, first employed in Public Law 99-500, and were not pertinent to the PON pursuant to Public Law No. 99-190.

CLEAN COAL TECHNOLOGY

Question 4: Statements that were made on predicted performance of clean coal technologies generally cited percentage reduction in SO_x and NO_x. This does not specifically address the crucial question, viz., "Will the effluent level, using this system, satisfy emissions requirements?"

Answer: Compliance with and exceeding environmental requirements were important parts of the Clean Coal Technology Program Opportunity Notice (PON). The PON, in Section IV.1(e), entitled, "Clean Air Act Compliance," required that the proposer must certify that, "as a minimum, the proposed technology in the specified market application will be capable of complying with the requirements of the Clean Air Act as amended, and with the relevant regulations promulgated thereto, in regions of the United States where commercialization of the technology is contemplated." Additionally, Section IV.2.1(a) of the PON, entitled, "Environmental, Health, Safety, and Socioeconomic (EHSS) Aspects," required, among other things, that the offeror "provide information on how applicable EHSS statutes and regulations (as of January 1, 1986) will be met in regions where significant market potential is projected. In this context, EHSS includes, but is not limited to, air quality and emissions, water quality and effluents, waste disposal, water resource requirements, health, safety, and, if applicable, socioeconomic aspects. A discussion must be provided stating how anticipated environmental emissions, occupational or public exposure to liquid and solid waste streams, intermediate process streams or products, and byproducts produced by the proposed technology will meet and exceed the requirements of these statutes and regulations, and whether there are any aspects that may present a problem in achieving compliance."

Furthermore, the companion evaluation criterion, contained in PON Section V.3.1.1(a), provided for the, "Degree to which the technology, used in integrated commercial applications as projected by the offeror, is likely to meet and exceed environmental, health, safety, and socio-economic (EHSS) statutes and regulations and to reduce or mitigate adverse EHSS and resource impacts. This includes, but is not limited to, discharges of wastes and pollutants to the environment, worker and community health and safety risks, socioeconomic impacts, and consumption of scarce resources such as fresh water, minerals, and land. Included therein is the ability to exceed environmental requirements in proposed applications that require better than minimum performance, such as locally stringent emission limitations or requirements for reducing emissions from existing facilities."

CLEAN COAL TECHNOLOGY

Question 5: Reduction in BTU cost per emission reduction is usually a pass-along to the utility consumer via the fuel rider. The utility does not realize additional earnings from burning cheaper fuels and, in fact, usually must invest in capital plant to burn these fuels. Would you recommend that any sort of tax incentive, or other "carrot" be given to a utility to promote installation of such equipment?

Answer: There is a legitimate basis for concern that electric power companies do not have adequate incentive to pursue capital investment necessary to reduce long term power costs. However, this problem is not best addressed with Federal incentives administered through the tax code or through other fiscal means for several reasons:

- As a matter of general policy, it is better to attack the barriers to efficient behavior rather than attempting to offset them with counter-vailing subsidies.
- These opportunities for and barriers against cost-effective capital investment vary substantially from region to region. An effort to correct problems should rely heavily on state authorities to allow for solution tailored to the particular situation.
- The Clean Coal Technology Program, however, can significantly contribute to the encouragement of utilities to use coal, and, for that matter, to consider high-sulfur content coal, by helping to provide a suite of new technologies for the economic combustion of these fuels in an environmentally acceptable manner.

CLEAN COAL TECHNOLOGY

Question 6:	DOE plans to have personnel from PETC and METC do the actual contract negotiations. Is there any guarantee that once the DOE General Counsel receives the agreements from the field offices that the awardees won't have to go through another set of negotiations?
Answer:	Although the Pittsburgh and Morgantown Energy Technology Centers (PETC and METC) are indeed taking the lead role in the conduct of negotiations of the cooperative agreements, DOE Headquarters personnel from the offices of Procurement, General Counsel, and Fossil Energy are actively coordinating their efforts with PETC and METC in regard to all aspects of the negotiations on an ongoing basis. Additionally, there is continuing coordination between PETC and METC themselves in order to ensure uniformity and consistency of approach. Once the negotiations have been concluded, there is no reason to believe that General Counsel, or any other office in DOE Headquarters, will require further negotiations, absent substantial cause for doing so.

CLEAN COAL TECHNOLOGY

Question 7: Once the 30-day report has been accepted by the Congress, how long will it take before the awardees receive some funding from the Department?

Question 8: How will payments be made? Lump sum, or through several equal allotments?

Answer: The report to Congress referred to in the question constitutes the last step prior to execution and implementation of the negotiated cooperative agreement between the offeror and the Department of Energy (DOE). A model of such cooperative agreement was provided in the PON as Appendix B. Attachment B, "General Provisions for Cost Sharing Cooperative Agreement," is an integral part of the model cooperative agreement. Provision Number 30 of Attachment B is entitled, "Allowable Cost and Payment." This provision states, among other things, that, "The Government shall make payments to the Contractor when requested as work progresses, but (except for small business concerns) not more often than once every 2 weeks, in amounts determined to be allowable by the Contracting Officer in accordance with the applicable cost principles ...," and, of course, in accordance with the negotiated cost sharing provisions provided in "Article III - Financial Support" of the cooperative agreement to include the PON requirement "Costs will be shared between DOE and the participant on an 'as expended,' dollar-for-dollar, basis (reconciled quarterly)." Additionally, the Model Cooperative Agreement provided for an Attachment D, "Billing Instruction," that will be inserted into the cooperative agreement at the time of award.

CLEAN COAL TECHNOLOGY

Question 9:	In your testimony, you mention that one of the agreements may be signed by the end of the year. Do you expect that negotiations will be completed with other projects within 90 days? 120 days?
Answer:	The Department of Energy (DOE) is making every effort to complete the negotiations and to execute the final cooperative agreements as expeditiously as possible. However, it is important to maintain cognizance of the many steps entailed in this process. These were described in our testimony presented on September 10, 1986. At this early stage in our negotiations with the nine selected candidates, DOE cannot reliably project when these negotiations will be completed. However, we remain optimistic that the first cooperative agreement will be in place by the end of calendar year 1986, and that the majority of the remaining agreements will be signed by April 1, 1987. Nevertheless, we must admit to the possibility that a few of the cooperative agreements may require a more protracted period of negotiation.

CLEAN COAL TECHNOLOGY

Question 10: Have additional staff been provided to METC, PETC and Headquarters to carry out the awardee negotiating process?

If not, are you expecting additional staff to be assigned in the near future?

Without additional staff, do you believe that you can provide quality management of these projects similar to that provided for the Great Plains Project?

Answer: While no additional staff has been provided to METC, PETC and Headquarters to carry out the awardee negotiating process, appropriate legal, technical and procurement personnel have been assigned at each location from their existing staff to participate in the negotiation process. These are experienced people with the right combination of skills. It is not anticipated that any additional staff will be needed in FY 1987 to support the Clean Coal program. We believe that the current staff is adequate and provides effective and efficient management of the Clean Coal program.

CLEAN COAL TECHNOLOGY

Question 11: What effect do you anticipate that the Clean Coal Technology program will have on the current DOE program with regard to funding levels and personnel levels?

Answer: Generally no adverse impact is anticipated upon current DOE programs as a result of the Clean Coal Technology program. Funds for the Clean Coal Technology program are separate and distinct from other DOE programs, and there is no overlap, with the other current programs. To some small degree, technical personnel have been shifted from other program areas to the Clean Coal Technology program.

CLEAN COAL TECHNOLOGY

Question 12: Could you point out the complementary relationship between certain projects or classes of projects and ongoing Fossil R&D activities?

Answer: The following relationships have been drawn in response to the question:

1. The Weirton Steel Corp. demonstration involves the direct iron ore reduction to replace the coke oven/blast furnace for the production of steel. The technology to be demonstrated will complement the ongoing surface coal gasification program.

2. The M.W. Kellogg Co. project utilizes fluidized bed gasification with hot gas cleanup in a combined cycle application. The fluidized bed gasification technology is a result of a cost-shared development by industry and the Department of Energy. The development of hot gas cleanup technology is an ongoing high priority research activity in the Fossil Energy Program. The General Electric proposal is the integration and demonstration of a coal gasification steam injection gas turbine concept which also includes hot gas cleanup. Data generated in earlier DOE R&D efforts with GE are being used to support the design of this clean coal project. The M.W. Kellogg and the General Electric demonstration projects and the ongoing Fossil research and development activities in surface coal gasification and hot gas cleanup are mutually complementary. The demonstration projects will provide

baseline technical and economic performance data which can help guide the research activities and the ongoing Fossil Research Programs can provide technical data which can be used in the design of specific subsystems in the demonstration plants.

3. The American Electric Power Service Corp. (AEP) project is the demonstration of a pressurized fluidized bed combustion (PFBC) project used in a combined cycle utility retrofit application. Although the concept is not identical with that being studied in the recently completed IEA/Grimethorpe PFBC program, the combustion data and operational information generated in the Grimethorpe work directly supports the AEP design effort and confirmed the data developed at the ASEA PFBC Malmo, Sweden test facility. The current Grimethorpe follow-on project will be complementary to this clean coal project as it will provide erosion/corrosion data from an updated U.S. designed in-bed tube bundle and a pilot scale coal water feed system. The schedule for these Grimethorpe tests would enable the data to be available as input to the final design of the AEP clean coal project. Further R&D support for the clean coal project will be available through a new DOE effort to develop the next generation of PFB coal combustors. This technology is projected to be 20 percent more economical and 10 percent more efficient than today's conventional coal-burning power stations.

4. The Energy & Environmental Research Corp. project involves gas reburning and sorbent injection into utility boilers. The Babcock and Wilcox proposal involves extended tests of limestone injection multistage burners plus sorbent duct injection. Both projects relate to the flue gas cleanup program.

5. The Coal Tech Corp. project is the continued development, through extended operation, of an advanced slagging combustor with sorbent injection. Currently, the DOE's advanced combustor program is cost-sharing a 50 hour shakedown and combustion characterization test on the 1 ton per hour Coal Tech Corp. combustor. The Clean Coal Program will continue the development of this combustor by supporting a 1000 hour demonstration test to generate the specific data necessary for scale up and commercialization. Both the R&D effort and the Clean Coal program complement each other in the development of this advanced combustor concept.

6. The Ohio Ontario Clean Fuels, Inc. project proposes to demonstrate the production of liquid fuels from coal through the use of a coal-oil coprocessing and a related liquefaction concept. Both concepts are being studied as part of the liquefaction R&D program. The data being generated in each will serve to support and confirm the design of the clean coal project while the operational data from that project can be used to focus the R&D effort on problems that hinder the advance of the state-of-the-art of the technology and its optimization for commercial application.

7. The Energy International, Inc. proposal involves underground coal gasification in a steeply dipping bed with the gases produced being used as a feedstock for an integrated indirect liquefaction process. Although the project will utilize a commercially available indirect liquefaction process, it will actually extend and utilize the data being generated in the DOE Underground Coal Gasification Program.

CLEAN COAL TECHNOLOGY

Question 13:	If projects from the standby list of 14 are selected for negotiation, what will DOE require in terms of additional information from the selectees?
Answer:	Should the Department of Energy (DOE) turn to one or more of the applicants on the standby list of 14 projects, the additional information that would be required of them would be of a similar nature and content to that now being required of the original group of nine selected offerors. As was discussed in the hearing of September 10, 1986, in brief, the offerors would be first asked to clarify ambiguities, supply missing information, etc., as the initial step toward negotiating cooperative agreements. This would be followed by reaching agreements on Statements of Work and the submittals by the offerors of proposed plans for the recovery of the Government's contributions and environmental monitoring plans. Subsequent to execution of the cooperative agreements, offerors would be required to submit additional environmental data in order to satisfy National Environmental Policy Act (NEPA) requirements, but this requirement also is no different than that for the group of nine offerors.

CLEAN COAL TECHNOLOGY

Question 14:	Once agreement has been reached between DOE and an awardee, is there a deadline to finish NEPA documentation and satisfy requirements?
Question 15:	What is the average time expected to be for receiving certification of environmental compliance for a project?
Answer:	There is no specific deadline that has been established for the completion of the process required by the National Environmental Policy Act (NEPA). Section III.27 of the PON, "National Environmental Policy Act (NEPA) Strategy," described the Department of Energy's (DOE) strategy for complying with NEPA requirements. Several features are:

1. All applicants awarded financial assistance will be required to prepare an Environmental Report using Appendix J of the PON, "Information Requirements for NEPA," as a guide.

2. DOE will use the Environmental Report to decide whether an environmental assessment and/or an environmental impact statement (EIS) is required, and, if so, DOE will prepare it. There is no automatic requirement that DOE prepare an EIS for successful proposals under the Clean Coal Technology Program. However, DOE is required to prepare appropriate project-specific NEPA documentation, and the level of appropriateness for any given proposal cannot be determined until the Environmental Report has been received and reviewed.

3. Cooperative agreements may be awarded and preliminary design work may be started before the NEPA process has been completed. However, Federal funds will not be provided for detailed design, construction, and operation until DOE informs the participant that the NEPA process has been successfully concluded.

Accordingly, it would not be appropriate to describe an average time for environmental compliance given the great variability between the projects.

CLEAN COAL TECHNOLOGY

Question 16:	Are you satisfied with the degree to which the projects selected will reduce existing emissions through retrofit applications?
Answer:	Yes. Although the Clean Coal Technology PON was considerably broader in scope than retrofit applications for emission reduction purposes, many of the projects selected should significantly reduce emissions when used in retrofit applications.

CLEAN COAL TECHNOLOGY

Question 17: Although the Congress did not specifically address the retrofit issue, isn't it important to consider this approach so that we not only assure the public that new plants will be low in acid rain emissions, but that the existing level of emissions can be affected through encouraging early retirement of these very significant sources of SO_x and NO_x?

Answer: There is no question that there is a need for cost-effective, retrofittable technologies that could be employed in the near-term to reduce emissions from existing coal-fired boilers, i.e., from sources that are not required to meet the Environmental Protection Agency's New Source Performance Standards (NSPS). Given the above, and in light of the economic realities that are causing electric utilities to emphasize power plant life extension, modernization, and repowering as options that are superior to the construction of new "grass roots" facilities, the development of retrofittable technologies, capable of 50 percent or better control of sulfur dioxide, can make an important contribution to the environment as well as to the supply of reliable electric power through the 1990's. It is for these reasons that the Department of Energy is pleased that, of the nine projects selected for negotiation of cooperative agreements, at least five of the projects would have specific application as a retrofit or repowering option for existing plants.

CLEAN COAL TECHNOLOGY

Question 18:	How will the RFP for retrofit-oriented projects recognize the potential effects of this recoupment disincentive?
Answer:	Public Law 99-500 provides for the Department of Energy's (DOE) "soliciting statements of interest in, and informational proposals for" projects employing emerging clean coal technologies for retrofit applications. This activity is being undertaken for analytical and assessment purposes. In light of this fact, the DOE Program Announcement does not consider or address recoupment.

CLEAN COAL TECHNOLOGY

Question 19: Was the recoupment factor incorporated in project ratings, e.g., was a project which promised early government payback given more weight than a similar project which required much longer payback time for the government loan, all other factors being equal?

Answer: Section VI.4 of the PON provided that, "Successful offerors will be required to submit a plan outlining a proposed schedule for recovering the Government's contribution." The nine selected applicants will be required to prepare and submit this plan only now that they have learned of the successful outcome of their proposals. Recoupment information was not required to be included in the proposals, and recoupment factors were not utilized in the proposal evaluation process.

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September 10, 1986

Donald L. Bauer
Acting Assistant Secretary for Fossil Energy
U.S. Department of Energy
Washington, D.C. 20515

Dear Mr. Bauer:

Thank you for your excellent testimony this morning before the Subcommittee on Energy Development and Applications. Enclosed are a number of questions Republican Members of the Subcommittee would like you to answer, in order to supplement the record of the hearing.

We would appreciate your responses to these questions by October 1, 1986. If you have any questions regarding this request, please contact Mr. David Beigtol of the Subcommittee Staff at 225-6399.

Sincerely,

Jim Sensenbrenner

F. JAMES SENSENBRENNER, JR.
Ranking Republican

HW:kg
Enclosure

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

Hearings to Assess the Department of Energy (DOE)
Clean Coal Technology Solicitation

Wednesday, September 10, 1986

Additional Republican Questions for Mr. Bauer

Administration Philosophy

1. Last year, when Congress was considering the level of appropriations for the Clean Coal Technology program, the Secretary of Energy sent a letter to Members of Congress which said in part that "the proposed demonstration forces the Federal Government to intervene in market place decisions in a programmatically unsound manner," and predicted that the program "will not accelerate the commercialization of new clean coal technologies." Is this still the Secretary's position?

2. In its May 1, 1985, Report to Congress on Emerging Clean Coal Technologies, the Department "concluded that Federal incentives will not accelerate the commercialization of these technologies and may be counterproductive to their development." Is this still the Department's position?

Cost Recovery/Recoupment

3. The Clean Coal Technology Program Opportunity Notice (PON) requires the project offerers to submit to DOE a plan outlining their proposed schedule for recovering the Government's contribution should the project proceed beyond the cost-shared operating phase.

   a. Is the "cost-shared operating phase" one that will be mutually agreed upon by the offerer and the Department?

   b. If a project generates any revenue during the initial operating phase, must such revenue be used to offset any project costs?

   c. May any such revenues be used to determine the Government's share of a project?

4. Please define exactly what is meant by "revenue" as it would apply to the cost-sharing provision. What about the case where a facility operates as a part of a utility system where identifiable revenues may not be allocated to a specific facility, or the case where a facility produces something that is consumed by the producer rather than sold to another entity?

5. Must revenues be shared for a retrofit project, even if the retrofit does not affect the amount of revenues produced, or doesn't account for the total cost of operation?

6. How would revenues for a retrofit project be shared if, in fact, the retrofit reduced operating costs, and thereby lowered revenues, as may happen in the case of a regulated utility?

7. It has been suggested that the repayment provisions contained in the PON had a "chilling effect" upon the number of retrofit technologies that were proposed, because there is little likelihood that the installation of such technologies would generate additional revenue. In fact, in a regulated utility environment, a retrofit that lowered the operating cost of the facility might well lead to lower revenues. Would you please comment on this observation?

Patent/Proprietary Rights

7. How are patent rights being addressed?

    a. Do the provisions of Section 9 of the Nonnuclear Energy Act apply to this program?

    b. Will waivers be available?

8. Will all demonstration operating data be available to the public or may some of it be withheld because it is "proprietary" or "business confidential"?

Environmental Standards

9. Do all the 9 selected projects and the 14 alternative projects meet the New Source Performance Standards (NSPS) for NO_x and SO_x? Which do not meet the NSPS?

10. The 3 retrofit projects (the LIMB/induct injection process; an advanced, air-cooled, cyclone combustor; and a combination gas-reburning and sorbent-injection process) have a SO_2 removal potential of only 50 - 60-percent while at least 70- to 80-percent SO_2 removal would be required to meet the 1.2 pounds SO_2 per million Btu NSPS standard while burning medium to high-sulfur coals. These technologies may, then, have very limited applications. What is the rationale for funding such projects?

Management Roles of DOE Headquarters and the Energy Technology Centers

11. What are the respective roles of the Energy Technology Centers and Headquarters in the negotiation phase of the program?

12. What are the respective roles of the Energy Technology Centers and Headquarters in the monitoring phase of the program?

Range/Size of Technologies Solicited/Selected

13. The technologies represented by the 9 selected proposals represent 7 of the 10 categories of coal technologies for which proposals were received. No project was selected in the categories of Coal Preparation and Waste Recovery, Atmospheric Fluidized-Bed Combustion (AFBC), or Gasification/Fuel Cells. Does indicate that these technologies are not promising clean coal technology candidates?

14. Many in the utility industry believe that AFBC technology is already commercialized and does not require any additional Federal support. Thus, in this view, additional demonstrations of the AFGBC technology are a waste of time and money.

    a. Does DOE agree with this view, and if not, why not?

    b. If DOE agrees with this view, what was the rationale for including 3 AFBC technology demonstrations in the alternate list of 14 projects?

15. What was the rationale for not selecting either any pre-combustion technology demonstrations, or any post-combustion technology demonstrations?

16. One of the significant requirements of the Clean Coal Technology Program Opportunity Notice (PON) was the need for the submitting organization to discuss the commercial potential of the technology being proposed. However, several of the 9 selected projects, including underground coal gasification and coal liquefaction, received unfavorable economic evaluation under commercial market conditions by the Synthetic Fuels Corporation. Why won't the economic viability of these technologies be equally difficult to achieve under the Clean Coal Technology program?

17. Seven of the 9 selected projects fall in the range of 5 - 70 MW, and it has been suggested that the projects in the size range may not be large enough to address adequately full-scale cost and performance issues. Would you please comment on this observation, and provide a rationale as to why the smaller-scale projects will indeed be able to be scaled appropriately?

PON Information Requirements

18. It has been suggested that the draft and final PON requirements for market analysis impacts and environmental information may have been overwhelming to many companies; that the detailed information required about the environmental, health, safety and socioeconomic aspects of each technology was premature and unreasonable at this stage of technology development; and that these added unnecessarily and substantially to the cost of propsal preparation.

    a. Please comment on this.

    b. Given the above criticisms, are you planning on revising and/or simplifying your information requirements for any future solicitations which may occur?

Other Questions

19. The State of Ohio received the lion's share of projects. How beneficial was it for the Ohio entities to have money from their state government?

20. Did any of the entities not selected for negotiation provide a cost-share over 50%?

21. Were there any states other than Ohio that provided money for Clean Coal technologies?

22. If negotiations fail with one of the winners, will DOE immediately proceed to look at the alternates, or will DOE wait until negotiations are completed with all the winners first, before moving on to the alternates?

Department of Energy
Washington, DC 20585

October 3, 1986

Honorable F. James Sensenbrenner, Jr.
Ranking Minority Member
Subcommittee on Energy Development
and Applications
Committee on Science and Technology
United States House of Representatives
Washington, D.C. 20515

Dear Mr. Sensenbrenner:

On September 10, 1986, Acting Assistant Secretary for Fossil Energy Donald L. Bauer appeared before the Subcommittee to discuss the Clean Coal Technology program.

Following that hearing, you submitted written questions for our response to supplement the record. Enclosed are the answers to those questions, which also have been sent directly to the Committee staff.

If you have any questions, please have your staff call Mike Gilmore or Cathy Hamilton on 252-4277. They will be happy to assist.

Sincerely,

Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosure

POST-HEARING QUESTIONS AND ANSWERS

Relating to the

SEPTEMBER 10, 1986, HEARING

Before the

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

of the

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

Witness: Donald L. Bauer
Acting Assistant Secretary for Fossil Energy

CLEAN COAL TECHNOLOGY

Question 1:	Last year, when Congress was considering the level of appropriations for the Clean Coal Technology Program, the Secretary of Energy sent a letter to members of Congress which said, in part, that "the proposed demonstration forces the Federal Government to intervene in market place decisions in a programmatically unsound manner," and predicted the program "will not accelerate the commercialization of new clean coal technologies." Is this still the Secretary's position?
Answer:	It is the Department's position that Clean Coal Technology funding constitutes a subsidy injected into a situation in which the private sector has already commenced development. The Department continues to support its previous statements on the relative roles of the Federal Government versus the private sector in the demonstration of new energy technologies. Nevertheless, the Department is acting prudently and responsibly in ensuring that the $400 million program is effectively implemented.

CLEAN COAL TECHNOLOGY

Question 2: In its May 1, 1985, Report to Congress on Emerging Clean Coal Technologies, the Department "concluded that Federal incentives will not accelerate the commercialization of these technologies and may be counterproductive to their development." Is this still the Department's position?

Answer: The Department's views regarding the role of the Federal Government have not changed. Nevertheless, the Department is working to ensure that the $400 million program is effectively implemented. Whether, in fact, the $400 million program will actually accelerate the commercialization of any of these technologies remains to be seen.

CLEAN COAL TECHNOLOGY

Question 3: The Clean Coal Technology Program Opportunity Notice (PON) requires the project offerors to submit to DOE a plan outlining their proposed schedule for recovering the Government's contribution should the project proceed beyond the cost-shared operating phase.

a. Is the "cost-shared operating phase" one that will be mutually agreed upon by the offeror and the Department?

b. If a project generates any revenue during the initial operating phase, must such revenue be used to offset any project costs?

c. May any such revenues be used to determine the Government's share of a project?

Answer: a. Section VI.4 (page VI-6) of the PON stated that:

- o It is the policy of DOE to recover an amount up to the Government's contribution to the project. Successful offerors will be required to submit a plan outlining a proposed schedule for recovering the Government's contribution. The recovery will be derived from the sum of the following potential revenue sources:
    1. Operations of the demonstration project beyond the operating phase of the cooperative agreement. The net revenue from the operation (after operating costs) will be shared in proportion to the overall cost-share for the project.
    2. The commercial sale, lease, manufacture, licensing, or use of the technology demonstrated under the Clean Coal Technology Program.
- o The decision of whether to dispose of the facility at the end of the cost-shared project, or whether to continue operating the facility at the proposer's expense, is solely the responsibility of the proposer and must be included

as part of the proposal (see SECTION IV.2.2(d)). Proceeds from the sale of project assets will be shared in proportion with the overall cost-share for the duration of the project.

The "operating phase of the cooperative agreement" referred to above will be mutually agreed upon by the applicant and the Department (as addressed in the Model Cooperative Agreement, Article II(C), "Project Performance," provided in the PON as Appendix B).

b. Revenues are not considered in computing cost-share.

c. No.

CLEAN COAL TECHNOLOGY

Question 4: Please define exactly what is meant by "revenue" as it would apply to the cost-sharing provision. What about the case where a facility operates as a part of a utility system where identifiable revenues may not be allocated to a specific facility, or the case where a facility produces something that is consumed by the producer rather than sold to another entity?

Answer: Revenues are not considered in computing the cost-share of either the Applicant or the Government. For the purposes of recovery of the Government's investment, revenue consists of the money received or imputed for the sale of products and by-products produced by the facility. For a facility that operates as part of a system, as in the case of an electric utility, where identifiable revenues may not be allocated to a specific facility, an alternative method may be used to determine revenue (e.g., the average system cost of electricity, or the price used for interutility electric power transfers).

Also, for a facility that produces a product that is consumed by the producer rather than sold, an alternative method may be used to compute revenues.

In the PON, "net revenue" in Section VI.4 was the difference between revenue and operating costs, and in the same Section "operating costs" consisted of the non-capital production costs and capital-related expenses as recognized and allowed by the Internal Revenue Service.

CLEAN COAL TECHNOLOGY

Question 5: Must revenues be shared for a retrofit project, even if the retrofit does not effect the amount of revenues produced, or doesn't account for the total cost of operation?

Question 6: How would revenues for a retrofit project be shared if, in fact, the retrofit reduced operating costs, and thereby lowered revenues, as may happen in the case of a regulated utility?

Answers: For a retrofit, the amount shared will be the difference in revenues (attributable to the retrofit) minus the difference in operating costs (attributable to the retrofit).

If a retrofit leads to reduced operating costs and revenues are reduced by a like amount (as may happen to a regulated entity), there is no net revenue to be shared.

CLEAN COAL TECHNOLOGY

Question 7:	It has been suggested that the repayment provisions contained in the PON had a "chilling effect" upon the number of retrofit technologies that were proposed, because there is little likelihood that the installation of such technologies would generate additional revenue. In fact, in a regulated utility environment, a retrofit that lowered the operating cost of the facility might well lead to lower revenues. Would you please comment on this observation?
Answer:	The repayment provisions and their interpretation were the subjects of several questions that were posed in connection with the Preproposal Conference of March 6, 1986. In the report of answers to the questions that were received, issued on March 24, 1986, it was stated that, for a retrofit, the amount shared would be the differences in revenues (attributable to the retrofit) minus the difference in operating costs (attributable to the retrofit). For example, if a retrofit leads to reduced operating costs and revenues are reduced by a like amount (as may happen to a regulated entity), there is no net revenue to be shared. In the example of a retrofit of an existing coal-fired plant to meet more stringent environmental requirements with no increase in a utility's rate of return, i.e., with no new revenue stream to provide funds to pay back DOE, DOE acknowledged that there may be no revenue stream to provide funds to pay back DOE from continued operation of the project after the period of performance of the Cooperative Agreement. However, there would be a potential for payback from the commercial sale, lease, manufacture, licensing, or use of the technology demonstrated under the Clean Coal Technology Program. See Section VI.4 of the PON (page VI-6).

Accordingly, we believe that there was ample clarification to offerors with regard to the repayment provisions. The Department notes that 51 proposals were received in response to the PON, of which about 16 were intended for utility applications, and, of that number, 75% were retrofit technologies. To date, DOE has encountered no evidence that there was a "chilling effect" upon the number of retrofit technologies that were proposed.

CLEAN COAL TECHNOLOGY

Question 7B:	How are patent rights being addressed? a. Do the provisions of Section 9 of the Nonnuclear Energy Act apply to this program? b. Will waivers be available?
Answer:	Section 9 (Patent Policy) of the Federal Nonnuclear Energy Research and Development Act of 1974 applies to this program for participants other than small business or nonprofit entities. In general, Section 9 provides that title to inventions resides in the Government, unless a patent waiver is obtained. In view of the substantial cost-sharing by sponsors, patent waivers will likely be available. However, waivers must be requested by such participants. Advance patent waiver requests may be submitted at any time prior to cooperative agreement execution or within thirty days thereafter. For participants that are small businesses or nonprofit, 35 U.S.C. 202, is applicable and provides for the automatic right to elect to retain invention rights without having to request a waiver.

CLEAN COAL TECHNOLOGY

Question 8:	Will all demonstration operating data be available to the public or may some of it be withheld because it is "proprietary" or "business confidential"?
Answer:	Data developed under the cooperative agreement that is delivered to the Government will be available to the public unless it is appropriately identified as "proprietary" or "business confidential" by the proposers. The Department intends to maximize the availability of operating data to the public. Negotiations are now underway with the nine selected offerors and have not been completed. Therefore, it would be premature to indicate the amount of "proprietary" or "business confidential" information that will be so identified.

CLEAN COAL TECHNOLOGY

Question 9:	Do all the nine selected projects and the 14 alternative projects meet the New Source Performance Standards (NSPS) for NO_x and SO_x? Which do not meet the NSPS?

Answer: The Proposal Preparation Instructions contained in the PON provided that, for the demonstration projects, proposers must discuss the ability to comply with the environmental, health, safety, and socioeconomic (EHSS) statutes and regulations for all phases of the project, EHSS risks and impacts of the proposed clean coal demonstration project, and suitability, quality and adequacy of the site and/or facility, including specifically EHSS requirements as of January 1, 1986, applicable to the demonstration, and evidence of the ability to comply with these requirements. (PON Section IV.2.2(c)). Additionally, among other things, offerors were instructed to address estimates of environmental discharges (air emissions, water effluents, liquid and solid wastes, etc.), and to describe discharge reductions to be achieved by the project or facility, with special emphasis on "before and after" comparisons if a retrofit proposal.

The corresponding technical evaluation criterion (PON Section V.3.1.2(c)) scored the adequacy and appropriateness of proposed approaches to comply with all EHSS requirements during all phases of the proposed project and to mitigate the risks and impacts of the EHSS aspects of the proposed demonstration project, and the suitability, quality, and adequacy of the site(s) and/or facility(ies) for the proposed demonstration.

Accordingly, where relevant, failure by an offeror to meet NSPS would have been reflected in the results of the technical evaluation for that offeror. However, it is important to note that NSPS would not be applicable to all of the nine selected projects nor to all of the 14 alternate projects. NSPS mandated by the Clean Air Act provide for limits on emissions from new coal-fired power plants on which construction or major modification began after 1977, but generally do not apply when existing units are upgraded or refurbished (unless certain conditions are satisfied that cause the refurbishment to be deemed as reconstruction or as a major modification). Similarly, in some instances, NSPS have not been promulgated by the Environmental Protection Agency for particular categories of emission sources.

Finally, as was discussed in the Selection Statement issued by DOE on July 25, 1986, as part of the strategy for compliance with the National Environmental Policy Act (NEPA), a "Pre-Selection Project-Specific Environmental Review" was prepared that focused on project-specific environmental issues. This analysis contained, for each proposed project that passed preliminary evaluation, a discussion of the site-specific environmental, health, safety, and socioeconomic issues associated with the demonstration project.

CLEAN COAL TECHNOLOGY

Question 10: The three retrofit projects (the LIMB/in-duct injection process; an advanced, air-cooled, cyclone combustor; and a combination gas-reburning and sorbent-injection process) have a SO_2 removal potential of only 50- to 60-percent, while at least 70- to 80-percent SO_2 removal would be required to meet the 1.2 pounds SO_2 per million Btu NSPS standard while burning medium to high-sulfur coals. These technologies may, then, have very limited applications. What is the rationale for funding such projects?

Answer: It is important to note the need for cost-effective, retrofittable, technologies that could be employed in the near-term to reduce emissions from existing coal-fired boilers, i.e., from sources that are not required to meet NSPS. These existing sources in some instances are using medium- to high-sulfur content coals that are suspected to contribute to acid deposition; presently available control options for such sources are either expensive or difficult to retrofit technologies, such as low-sulfur coal with concomitant concerns such as increased costs, employment dislocations, etc. Additionally, while not subject to NSPS, these existing boilers may be subject to State Implementation Plans which may provide for additional implementation of emissions reductions over some period of years.

Accordingly, given the above, and in light of the economic realities that are driving utilities to emphasize power plant life extension, modernization, and repowering as superior options to new "grass roots" facilities, the development of retrofittable technologies capable of 50 percent or better control of sulfur dioxide, can make an important contribution to protection of the environment as well as to the supply of reliable electric power through the 1990's. The three retrofit technologies described are responsive both to the needs of industry and the utilities. In addition, two other retrofit technologies being developed in the program (i.e., the pressurized fluidized bed combustor (PFBC) and the integrated gasification combined cycle (IGCC) systems provide other options for the utility sector well suited to accomplishing the objectives of the program in reducing any emission of SO_x and NO_x.

CLEAN COAL TECHNOLOGY

Question 11: What are the respective roles of the Energy Technology Centers and Headquarters in the negotiation phase of the program?

Answer: The respective Energy Technology Centers are to perform the negotiations and execute the Cooperative Agreement with each project sponsor. Headquarters will perform an overview function and have approval authority for certain key activities. Some of these key activities reserved for Headquarters include approval of negotiation plans and fully negotiated Cooperative Agreements, Environmental Monitoring Plans, key milestone schedule dates, and budgetary limitations. In addition, some National Environmental Policy Act requirements will be controlled by Headquarters, as well as reports to Congress.

CLEAN COAL TECHNOLOGY

Question 12: What are the respective roles of the Energy Technology Centers and Headquarters in the monitoring phase of the program?

Answer: The Energy Technology Centers will perform the monitoring of each assigned project. Project monitoring will include gathering data, performing analyses, and making recommendations to individual project sponsors or Headquarters. Headquarters will perform program overview functions and have approval authority for certain key activities. Some of these key activities include control of the cost overrun reserve, changes in key milestone dates, and approval authority to move from one phase to another. Headquarters will also prepare overall program evaluation reports and Clean Coal Program Plans for each Technology Center.

CLEAN COAL TECHNOLOGY

Question 13: The technologies represented by the nine selected proposals represent seven of the ten categories of coal technologies for which proposals were received. No project was selected in the categories of Coal Preparation and Waste Recovery, Atmospheric Fluidized-Bed Combustion (AFBC), or Gasification/Fuel Cells. Does this indicate that these technologies are not promising clean coal candidates?

Answer: The nine selected proposals were the culmination of a lengthy process of evaluation and consideration that has been described in the Selection Statement issued on July 25, 1986, in testimony, and elsewhere. There was no predetermined decision to exclude, or for that matter to include, any particular technology or process, rather, the proposals were selected as representing "the best" projects from within the population of available candidates after applying the evaluation criteria and program policy factors stated in the PON. Of the initial 51 proposals received, 12 failed preliminary evaluation. One additional project was withdrawn by the offeror. This left a field of 38 viable proposals from which the final primary (9) and secondary (14) selections were made. The 14 alternate selections include projects in coal preparation, AFBC and gasification/fuel cells.

CLEAN COAL TECHNOLOGY

Question 14: Many in the utility industry believe that AFBC technology is already commercialized and does not require any additional Federal support. Thus, in this view, additional demonstrations of the AFBC technology are a waste of time and money.

a. Does DOE agree with this view, and if not, why not?

b. If DOE agrees with this view, what was the rationale for including three AFBC technology demonstrations in the alternate list of 14 projects?

Answer: The Department believes that intermediate to large-sized (200,000 lb/hr steam and greater) industrial AFB units have reached the commercial stage. This opinion is based upon the fact that 19 boiler manufacturers are currently offering the technology and approximately 90 industrial units are operating in the U.S. There are currently three AFB utility demonstrations in the design and construction phase. These demonstrations are the 160 MWe TVA project, the 110 MWe Northern States Project (Blackdog) and the 100 MWe Colorado-Ute project. However, these projects have not yet begun operation. The Clean Coal Technology Program mandated by Congress did not specifically exclude any coal-fired technology. Congressional language emphasized utility applications and those technologies which are ready for demonstration. It is our opinion that AFB utility demonstrations comply with the Congressional guidance and currently should be included as an emerging clean coal technology. All AFB proposals for utility applications were evaluated against the criteria used to evaluate all other proposals and the three projects received relatively high scores.

CLEAN COAL TECHNOLOGY

Question 15: What was the rationale for not selecting any pre-combustion technology demonstrations, or any post-combustion technology demonstrations?

Answer: In fact, a post-combustion technology (Babcock and Wilcox's coolside sorbent injection technology) was included in the nine projects selected for negotiation. The other proposals selected were considered as representing "the best" projects from among the proposals received after applying the evaluation criteria and program policy factors stated in the PON.

CLEAN COAL TECHNOLOGY

Question 16: One of the significant requirements of the Clean Coal Technology Program Opportunity Notice (PON) was the need for the submitting organization to discuss the commercial potential of the technology being proposed. However, several of the nine selected projects, including underground coal gasification and coal liquefaction, received unfavorable economic evaluation under commercial market conditions by the Synthetic Fuels Corporation. Why won't the economic viability of these technologies be equally difficult to achieve under the Clean Coal Technology Program?

Answer: It is difficult to answer this question directly in the absence of more information regarding the particular technological approaches considered by the Synthetic Fuels Corporation (SFC), the commercial market conditions they assumed, and the assessment criteria employed by the SFC. However, it is important to note the cost-sharing aspect of the present PON, wherein the private sector offeror assumes an economic risk at least equal, and often greater, than that of the Federal Government. Specifically, for the two projects identified in the question, offeror shares are 51% for the underground coal gasification project and 80% for the coal liquefaction project.

Finally, although "Marketability" indeed was an important technical evaluation criterion, it was one of three commercialization factors that were considered, in addition to which there were four demonstration project factors. The commercialization factors taken together were worth slightly less than half the total point score for the technical evaluation criteria.

CLEAN COAL TECHNOLOGY

Question 17: Seven of the nine selected projects fall in the range of 5-70 MW, and it has been suggested that the projects in this size range may not be large enough to address adequately full-scale cost and performance issues. Would you please comment on this observation and provide a rationale as to why the smaller-scale projects will indeed be able to be scaled appropriately?

Answer: Since a specific size demonstration project was not dictated by the Clean Coal Technology legislation, reasonable engineers might disagree about the size range which is large enough to address full-scale cost and performance issues. Likewise reasonable engineers might disagree as to how much of a scaleup is reasonable to go from a demonstration project to a commercial application, or how much demonstration operating time is sufficient to justify any commercial application. Part of the decision as to the size of the projects came from the sponsors themselves who are considered to be in the best position to know the peculiarities of their business.

Appropriateness of demonstration scales depends on the nature of the technology and the type of risks encountered in scale-up to commercial size. Several of the technologies are modular in nature so that added capacity can be achieved by adding more units of similar size.

CLEAN COAL TECHNOLOGY

Question 18: It has been suggested that the draft and final PON requirements for market analysis impacts and environmental information may have been overwhelming to many companies; that the detailed information required about the environmental, health, safety and socioeconomic aspects of each technology was premature and unreasonable at this stage of technology development; and that these added unnecessarily and substantially to the cost of proposal preparation.

a. Please comment on this.

b. Given the above criticisms, are you planning on revising and/or simplifying your information requirements for any future solicitations which may occur?

Answer: The PON was developed as the culmination of a lengthy and scrupulous effort to produce a solicitation that would result in the selection of those projects meritorious of financial assistance, including taking the uncommon step of providing a draft PON for public comment. The information that was requested in the PON was stipulated in order to obtain the salient data necessary for evaluation. We have only anecdotal evidence that prospective offerors chose not to respond because of the quality or quantity of the information requested in the PON. We also would like to point out that, of the nine selected projects, at least three of the offerors are somewhat smaller enterprises. We do not believe that the PON extended any particular advantage to the larger firms or entities.

In light of the fact that there is no appropriation presently in place for a future funded solicitation, we cannot speculate on the nature and extent of the information requirements that might be needed and employed in such a solicitation.

It should also be noted, however, that at some point in the negotiation process leading to the execution of a contract all of the information requested in this PON would be required.

CLEAN COAL TECHNOLOGY

Question 19: The State of Ohio received the lion's share of the projects. How beneficial was it for the Ohio entities to have money from their State government?

Answer: Of the 51 proposals submitted, 42 publicly identified the project location by state. Twenty-one, or 50% of these identified, were located in Ohio, Pennsylvania, and West Virginia. Not surprisingly, these states contain large deposits of high sulfur coal deposits and a significant portion of the nation's coal-fired power plants utilizing high sulfur coal. The fact that a project was to be specifically located in Ohio made no difference in the evaluation process. However, monies offered by the State of Ohio probably allowed more project sponsors to find sufficient co-funders to produce teaming arrangements with 50% of the funds required to qualify for Department financial support. Also, by advertising specifically for clean coal technologies, Ohio may have prompted local responses that were not forthcoming from many other states. How beneficial this was for Ohio entities is difficult to measure, but it probably had some impact on the number of projects submitted to the Department.

CLEAN COAL TECHNOLOGY

Question 20: Did any of the entities not selected for negotiation provide a cost-share over 50%?

Answer: Several of the entities not selected for negotiation did provide offers to cost-share more than 50% of the total estimated cost of the proposed projects. This consideration was one of the business and management evaluation criteria, which stated, "Degree of priority placed by top management on the project, including the extent of costsharing above fifty percent" (PON Section V.3.2).

CLEAN COAL TECHNOLOGY

Question 21:	Were there any states other than Ohio that provided money for Clean Coal Technologies?
Answer:	Among the 51 proposals received, there were indications by certain sponsors that money for Clean Coal Technologies would be available from the state governments of New York, Pennsylvania, Illinois, Minnesota, and West Virginia, as well as Ohio.

CLEAN COAL TECHNOLOGY

Question 22: If negotiations fail with one of the winners, will DOE immediately proceed to look at the alternates, or will DOE wait until negotiations are completed with all the winners first, before moving to the alternates?

Answer: It is, of course, entirely possible that a successful conclusion may not be reached with one or more of the applicants. Upon completion of the negotiation and award process with the entire group of nine applicants, we will then have definitive information as to with which project(s), if any of the nine, DOE has failed to execute a cooperative agreement. At that juncture, we would be able to ascertain the totality of the funds available for support of projects from the group of fourteen alternates, and we would also be aware of the array of technologies represented by the projects that successfully signed cooperative agreements.

Accordingly, we would then turn to the alternates for the selection of replacement project(s). It is important to note that no predetermined selections have been made among the fourteen alternate projects, either with regard to specific applicants or with regard to particular technologies. If and when it becomes appropriate, we will then consult the evaluation criteria identified in the PON, and apply the program policy factors, also stipulated in the PON, to select an appropriate project or projects.

Mr. Fuqua. Our first panel consists of representatives from four organizations who have been very supportive of our congressional efforts to implement the Clean Coal Technology Demonstration Program. I want to welcome Mr. Ben Yamagata from the Clean Coal Technology Coalition, Mr. Mike High from TVA, Mr. Kurt Yeager from EPRI, and Dr. William Harrison, representing the Edison Electric Institute.

And also due to time constraints, I would like to ask that each of you keep your oral statements down to 10 minutes, and we will hear from the four panelists first and then we will go to questions and answers. If all of you wish to take your places at the table.

Ben, we will be pleased to hear from you at this time.

STATEMENT OF BEN YAMAGATA, EXECUTIVE DIRECTOR, CLEAN COAL TECHNOLOGY COALITION

Mr. Yamagata. Thank you, Mr. Chairman, members of the subcommittee. My name is Ben Yamagata. I serve as the executive director to the Clean Coal Technology Coalition.

The coalition was organized for the specific purpose of supporting and encouraging the demonstration of emerging clean coal technologies and their subsequent widespread commercial use. Forty different entities now compose the membership of the coalition. A list of our members is attached to my written statement.

We know of your leadership, Mr. Chairman, and that of Mrs. Lloyd, Mrs. Schneider, Mr. Walgren, Mr. Boucher, and other members of this subcommittee in convincing the Congress last year to support the appropriation of nearly $400 million out of the Clean Coal Technology Reserve for purposes of initiating this program. Overwhelming congressional support of funding for this partnership between the Government and the private sector was a clear signal to our members that a very high priority was being placed upon the development of these emerging technologies. I am pleased today to be able to join in this discussion about the Clean Coal Program with John McCormick of the Environmental Policy Institute, who is a strong and able advocate for clean coal technology development and will be addressing this subcommittee as a participant on the next panel.

While the environmental community and various members of our coalition often find themselves at loggerheads over other issues, clean coal technology development is one endeavor where our hands were joined. We mutually seek to encourage the production of energy from coal through the utilization of energy—from clean coal technologies that are cost-effective and environmentally acceptable.

I am submitting a detailed written statement with the coalition's views and, to remain within the allotted time, I will confine my comments to three related issues. First, the role of clean coal technologies in meeting electricity and industrial energy requirements in an environmentally acceptable manner. Second, our analysis of the current status of DOE's implementation of the Clean Coal Program. And third, a set of recommendations on behalf of the coalition for future actions by the Congress.

While there is disagreement over the rate of growth in electricity demand, most projections with which we are familiar indicate that sometime in the next decade additional capacity above that already installed or ensured of construction will be required. Depending upon the price and availability of other fuels, coal is likely to play a pivotal role in meeting these capacity increases. Accelerated development of promising technologies will increase the range of options for new plant construction. How fast these technologies are put into the marketplace will determine whether they can assist in meeting these capacity needs in the nineties.

These technologies are attractive because some are capable of being constructed in modules or in increments, they can use a wide variety of coal to ensure fuel flexibility, and they are projected to meet or exceed current environmental requirements. Many of the problems currently facing the electric utility industry with respect to new or replacement capacity get positively addressed in these technologies. There is also growing awareness in the utility industry that the extension of plant life can be far less costly and less risky than embarking upon a program to build replacement capacity. Several clean coal technologies, if found to be cost-effective, will be particularly useful in obtaining emission reductions as part of plant life extension programs. Where successfully retrofitted with cost-effective clean-coal technologies an existing facility could attain the dual goals of continued reliable energy supply and reduced emissions.

In July, Mr. Chairman, DOE selected 9 clean coal projects out of 51 submitted. Another 14 projects, as you have noted, were also identified for possible negotiations in the event contracts are not signed with the first 9. While we are not in a position to comment upon the projects chosen, I would observe that certain technology areas, specifically pre- and post-combustion clean-coal technologies, were not represented among those nine. Further, the number of proposals submitted for demonstrating retrofittable technologies to be applicable to existing facilities, especially low-cost combustion modification techniques, was disappointing.

We believe that the development of these retrofittable technologies for existing facilities is very important as utilities consider which, if any, facilities might be maintained in service for a period of time beyond their originally expected useful life.

The initial confusion over DOE's requirements for repayment of the Government's contribution and the extensive and expensive marketing and environmental impact reports required under the solicitation appear to have discouraged projects from submitting. These disincentives may have been especially severe for projects involving the retrofit of a clean-coal technology to an existing facility.

The House of Representatives has already adopted a provision included in the fiscal year 1987 Interior and related agencies appropriations bill which would direct the DOE to conduct a second statement of interest solicitation for clean-coal technology projects designed to retrofit, repower, or modernize existing facilities. Those cumbersome requirements that were required in the Department's first clean-coal technology solicitation must be excluded from any subsequent solicitation if industry is to enthusiastically respond.

Finally, with respect to the ongoing negotiations with projects already selected, there is growing concern over the requirement that contracts between the Government and the project sponsors must lie before the Congress for 30 days. With the Congress about to adjourn sine die, there is a real possibility that the 30-day requirement might substantially delay the completion of negotiations and the start of these projects.

On behalf of the Clean Coal Technology Coalition, I would make the following recommendations for the subcommittee's consideration. First, the Congress is urged to adopt the recommendation that the DOE be directed to conduct a second statement of interest solicitation for clean-coal technologies to retrofit, repower, or modernize existing facilities. Second, every effort should be made to ensure that industry and other potential respondents to such a solicitation will not be required to meet the substantial requirements of the first solicitation. Indeed, because the solicitation is merely to seek a statement of interest, the information sought should be limited to determining the degree of that interest. Third, if a substantive case is made that sufficient interest exists, then Congress should consider the appropriation of some or all of the $350 million remaining in the Clean Coal Technology Reserve. Fourth, the 30-day requirement mentioned previously is likely to be a significant source of delay and the Congress is asked to rescind the requirement or develop a procedure that will assure that timely review is accomplished. Fifth, it is vitally important that interested congressional committees initiate an investigation as to what changes, if any, are required in statute or regulation to ensure that once technologies are demonstrated they will then be widely incorporated by coal-using industries as a means to produce electricity or energy from coal. The coalition has initiated such an effort among our members and we would welcome the opportunity to work with the Congress on this very important matter and to share with you our recommendations and findings. And finally, if current acid rain control legislation were to be enacted, the Congress must be mindful that all clean-coal technologies will not be developed and made available for commercial use within the timetables of mandatory reductions now under discussion.

Mr. Chairman, we appreciate this opportunity to testify. The membership of the Clean Coal Technology Coalition applauds the support you and other members of this subcommittee have given to this program. With continued congressional support, the Clean Coal Program will be a success in demonstrating technologies that will ensure that the environment is protected, that consumers are provided with least cost and reliable electricity, and that our Nation's most abundant fossil fuel resource is widely and extensively used.

Thank you.

Mr. FUQUA. Good timing.

Mr. YAMAGATA. Thank you.

[The prepared statement of Mr. Yamagata follows:]

HEARINGS BEFORE THE
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WRITTEN STATEMENT OF
BEN YAMAGATA
EXECUTIVE DIRECTOR
CLEAN COAL TECHNOLOGY COALITION
SEPTEMBER 10, 1986

INTRODUCTION

This statement is submitted by the Clean Coal Technology Coalition, an ad hoc group of electric utilities, equipment suppliers, coal companies, architect-engineering and construction firms, several state governments, the National Coal Association and the Edison Electric Institute. Our membership now exceeds forty; a list of our current members is attached to this testimony for the information of the Committee.

The Clean Coal Technology Coalition (CCTC or Coalition) was organized in the spring of 1985 for the specific purpose of encouraging the implementation of the clean coal technology demonstration program. Our membership endorses this industry/government partnership and we believe that this important cost-sharing initiative can accelerate the commercial demonstration of emerging technologies that will allow us to use coal in a cost-effective and environmentally acceptable manner.

The membership of the Coalition applauds the efforts of Members of this Committee in the leadership role provided last year to ensure the appropriations of funds out of the $750 million Clean Coal Technology Reserve. We appreciate the difficultly each Member has confronted as choices are made to establish national priorities while working within severe budget constraints. Upon the urging of many Members of this Committee, the House of Representatives, during debate on the Fiscal Year 1986 Interior and Related Agencies' appropriations bill and by a vote of 317 to 98, reaffirmed recommended appropriations to the clean coal program. This very impressive showing of Congressional support was clear evidence to industry and to the membership of the Coalition of the support for this program within the Congress.

The clean coal technology demonstration program is also the product of many interests outside of the Congress. Establishment of this major new federal initiative at a time of very significant opposition from the Executive Branch was the result of support not only from affected elements of the coal using industries but also, and importantly, support from the environmental community. The common goals of benefitting electric utility ratepayers, the environment and the development and utilization of our nation's vast coal resources, have helped to coalesce the support of various parties that have, in times past, been on opposite sides of an issue. Clean coal technology development is the glue that holds this larger community of common interests together and we believe that continued support from each of these groups is vitally important to the ultimate success of the program.

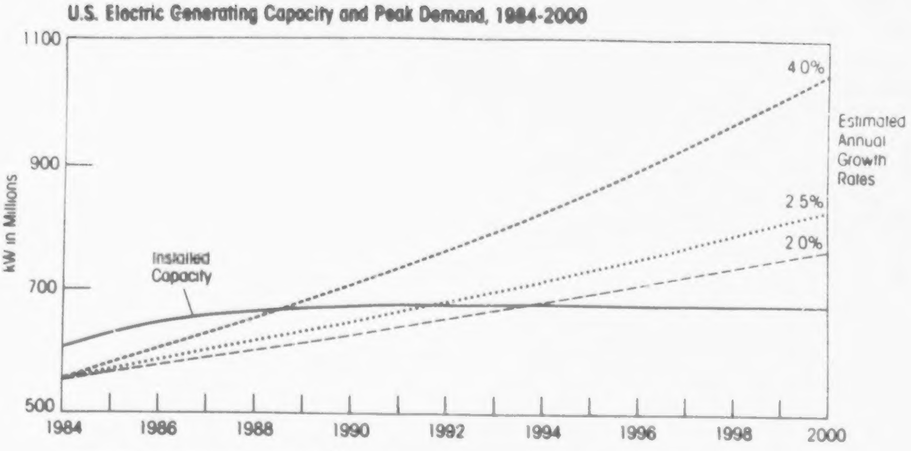
The House Science and Technology Subcommittee on Energy Development and Applications is to be commended for conducting these hearings on the clean coal technology program. The Department of Energy's implementation of that program and possible further actions by the Congress, including appropriations of the remaining $350 million in the Clean Coal Technology Reserve are important matters that should be considered at this time. We also believe that these hearings and others being conducted in the Congress will greatly assist in focusing attention not only on the need to reduce emissions but also on the need to provide reliable and least-cost energy to American consumers. These comments will focus upon (i) the role of clean coal technologies in meeting electricity requirements in an environmentally acceptable manner; (ii) the current status of DOE's implementation of the program; and, (iii) a set of recommendations, on behalf of the Clean Coal Technology Coalition, for future actions by the Congress.

THE ROLE OF COAL AND EMERGING CLEAN COAL TECHNOLOGIES:

There has been much disagreement over projected growth rates of electricity, and this uncertainty obviously affects the pace at which new technologies may actually be incorporated into the generating base. Most forecasters have projected growth rates between 2.0 and 4.0 percent annually.

The generating capacity currently installed or assured of construction is likely to support an average growth rate in electricity demand of less than one percent per year over the remainder of this century.

From 1945 through 1972, maximum demand for electricity, which determines the amount of generating capacity required, grew at an annual rate of 7.7 percent. Between 1973 and 1983, the demand for electricity continued to grow, albeit at a reduced rate. Peak demand increased at an annual growth rate of 2.7 percent which closely tracked the growth in the gross national product. If demand requirements keep pace with economic growth, then an increase in demand at a modest 2.5 percent growth rate may not be unreasonable. The Edison Electric Institute has projected that for an annual growth rate of 2.5 percent, sometime in the early to mid-1990's peak electricity demand is expected to exceed installed capacity and new capacity above what is already planned will be required (see chart below).



U.S. Electric Generating Capacity and Peak Demand, 1984-2000

Note: Peak demand at stated growth rates with 20% capacity margin needed for dependable supply. Includes existing capacity and capacity under construction less retirements of 15 million kilowatts through 1993 as reported to NERC

U.S. Electric Generating Capacity and Peak Demand, 1984-2000
Report of the Edison Electric Institute on Nuclear Power, page 21, February, 1985.

At a 2.5 percent rate of growth, the U.S. will still require 100,000 to 200,000 megawatts of additional new capacity this century. Much of this capacity is likely to be fueled by coal. It is within this context of the ever-growing reliance upon coal and a probable increased demand in electricity supply that the clean coal technology development program plays its pivotal role.

New Generating Capacity:

If the projected capacity needs of the mid-1990's are to be met with conventional generating units that take from seven to ten years to design, permit, construct and place in service, utilities must undertake those new powerplants now. Current trends in the utility industry strongly suggest that these new capacity requirements may not be built in time to meet this increased demand. At least part of the concern that new capacity requirements may not be met is premised upon the significant unknowns which face the industry. These unknowns include: possible additional environmental legislation and environmental regulation which might impact the continued service of existing units; further nuclear deferments; oil supply interruptions; and, the yet-to-be-proven ability concurrently to increase both the availability and life of existing capacity and the success of further conservation, load management efforts and other demand-reducing programs.

Added to these uncertainties is the fact that many utilities have cancelled or abandoned the construction of large base load facilities and are now unlikely to undertake major new construction programs. Also, new demand and, therefore, new capacity requirements for many utilities are likely to come in much smaller increments which may not warrant construction of large-scale conventional powerplants. And finally, because the growth of electricity demand has slowed considerably, any miscalculations by utility planners in projecting demand could result in excess capacity being built. The cost of such capacity cannot be easily recovered in rate proceedings. These and other circumstances cause utilities to be ever more cautious in adding capacity.

Accelerated development of promising technologies will increase the range of options for new plant construction. How fast these technologies are put into the marketplace will determine whether they can assist in meeting capacity requirements in the 1990's. Such technologies as atmospheric and pressurized fluidized bed combustion and coal gasification, among others, which are capable of meeting New Source Performance Standards will provide alternatives to today's conventional pulverized coal units with their Federally-mandated flue gas scrubbers.

Retrofitting Existing Capacity:

In addition to new capacity requirements in the 1990's, there is also growing awareness within the utility industry that the extension of plant life can be far less costly and less risky than embarking upon a program to build replacement capacity. Certain emerging clean coal technologies, like the LIMB process, other dry sorbent injection processes, advanced combustors, fluidized bed boilers and in-duct scrubbing, are representative of technologies which, if found to be cost effective, could be particularly useful in obtaining emission reductions as part of plant life extension programs. These technologies could be applied to repower and increase the efficiency of existing plants, to reduce the emissions of sulfur dioxide, particulates and/or nitrogen oxides from these plants, or to otherwise modernize these units which still possess an economically useful life to produce electricity.

The potential for extended refurbishment of fossil-fuel fired plants in meeting future load demand projections is underscored by the Electric Power Research Institute (EPRI) estimates that some 55,000 MW of coal-fired and 40,000 MW of oil/gas capacity will exceed 40 years of age between now and the year 2000. Forty years has often been judged as the economically useful life of electric generating units. Not all of these aging units will be maintained in service beyond the original projected useful life. However, the total amount of the electric utility industry's aging stock and the apparent attractiveness of maintaining these units in the generating base, strongly suggests that the development of clean coal technologies that can cost-effectively extend the life of these facilities and also reduce emissions, is a set of options worthy of aggressive pursuit.

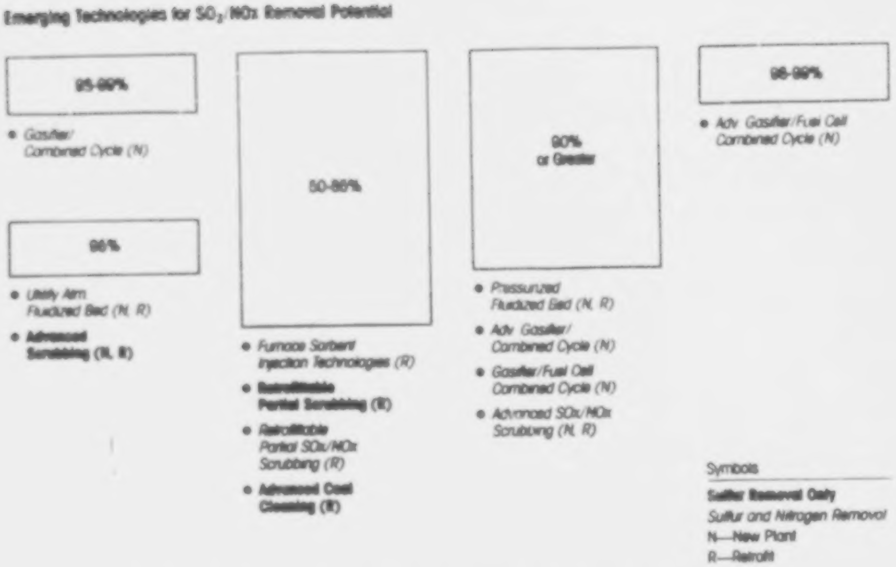
EPRI has estimated that refurbishment is attractive because new unit construction costs now range from 1200$/kW to 2000$/kW. In contrast, according to EPRI, extending the life of existing units for an additional 10 to 25 years by refurbishment may be achievable for 150$/kW to 300$/kW coupled with more intensive diagnostic and planned maintenance efforts during the extended life period. These costs may be justified if the desired availability can be confidently maintained for the additional period of life extension desired.

The decision by utilities to implement extended refurbishment depends on a variety of complex factors, including reserve margins, financial condition, load growth estimates, size, condition, age, fuel use and heat rates of the units under consideration and applicable environmental standards. Not all aging capacity, therefore, is expected to be life extended even if technically feasible to do so.

Further, it should be noted that the utility industry has had little experience to date with extended refurbishment and, potentially, a number of unforeseen problems may surface that could drive capital and other costs much higher.

THE NEED TO PROTECT AND ENHANCE THE ENVIRONMENT:

Beyond the need for additional capacity in the 1990's, coal use will be paced by our ability to protect the environment. This is, perhaps, where emerging technologies will provide the greatest beneficial impact. Conventional coal fired powerplants can comply with current and proposed environmental requirements by installing conventional scrubbers, but the dollar costs could be very high. Many new technologies are capable of controlling more than just one pollutant stream and promise to be more economic than scrubbers. By achieving significant reductions in emissions of multiple, not individual, pollutants, new clean coal technologies appear to be a far more productive use of scarce investment dollars and could provide users of coal with additional options with which to meet environmental requirements (see chart below).


Emerging Technologies for SO_2/NOx Removal Potential
95-99%
• Gasifier/ Combined Cycle (N)
90%
• Utility Atm Fluidized Bed (N, R)
• Advanced Scrubbing (N, R)
50-80%
• Furnace Sorbent Injection Technologies (R)
• Retrofittable Partial Scrubbing (R)
• Retrofittable Partial SOx/NOx Scrubbing (R)
• Advanced Coal Cleaning (R)
90% or Greater
• Pressurized Fluidized Bed (N, R)
• Adv Gasifier/ Combined Cycle (N)
• Gasifier/Fuel Cell Combined Cycle (N)
• Advanced SOx/NOx Scrubbing (N, R)
98-99%
• Adv Gasifier/Fuel Cell Combined Cycle (N)
Symbols
Sulfur Removal Only
Sulfur and Nitrogen Removal
N—New Plant
R—Retrofit

Emerging Technologies for SO2/NOx Removal Potential
Department of Energy, 1985

CURRENT STATUS OF THE CLEAN COAL TECHNOLOGY PROGRAM:

Congress recognized the need for the Federal government to assist in the accelerated demonstration of clean coal technologies by first authorizing the $750 million Clean Coal Technology Reserve and then appropriating, last year, nearly $400 million out of that Reserve to initiate the clean coal program. At the direction of the Congress, the Department of Energy has rapidly implemented this program. In response to a DOE solicitation requesting proposals, fifty-one submittals were made in April, 1986, and by July, 1986, nine projects had been selected for further negotiations with the DOE. Another fourteen projects were also identified by the DOE for possible negotiations in the event cooperative agreements are not consummated with some or all of the initial nine projects. The Department is to be commended for its timely compliance in the review and selection of these projects.

The Clean Coal Technology Coalition has not made a thorough analysis of the proposals selected. Information available to the public is modest and limited to brief DOE descriptions of selected projects or to abstracts of projects which were prepared by the proposers. While we will not comment upon the individual projects chosen we would observe that pre-combustion and post-combustion clean coal technologies were not among the proposals selected for demonstration. Further, the number of proposals for projects intended to demonstrate low cost combustion modifications to existing facilities was disappointing. We believe that the development of these retrofit technologies for existing facilities is very important as utilities consider which, if any, aged or aging facilities might be maintained in service for a longer period of time.

Why a great many more projects to demonstrate retrofit technologies were not proposed is a subject of much speculation.

First, the draft program opportunity notice which DOE originally issued to solicit clean coal projects caused considerable confusion among potential proposers. In that solicitation, the Department proposed to require that the government's portion of project costs be repaid out of revenues generated by the project. Because there is little likelihood that the installation of a retrofit technology results in additional revenues, where the purpose of such technologies is simply to limit emissions and not increase or generate additional revenues from the facility, the requirement for repayment had a "chilling" effect upon the program. This is especially so in light of the fact that many in industry interpretted the actions of Congress to be the creation of a grant, not a loan, program. DOE's repayment requirement redesigned the program. In addition, the DOE required the preparation and submission of extensive and expensive reports regarding the potential market and environmental impacts of successfully demonstrated technologies no matter where those technologies might eventually be utilized. These requirements, some of which were not required in the final solicitation, created a negative impression about the program and may have caused many not to propose at all.

Second, there is considerable uncertainty about the regulatory treatment of some clean coal retrofit technologies. Some of these technologies fall short of attaining NSPS, and the specter of a retrofitted plant having to meet ever more stringent environmental control standards may inhibit the development of many of these technologies. That possibility also may have convinced some not to propose spending private funds on technologies which, while achieving substantial emission reductions and extending plant life reliability, may be immediately obsolete by changes in environmental regulations.

The House has passed and the Senate Appropriations Committee has approved a provision in the Interior and Related Agencies Appropriations bill for F.Y. 1987 that would require the DOE to again solicit statements of interest from industry for the demonstration of technologies to retrofit, repower or modernize existing facilities. If those cumbersome requirements which appeared in the first program opportunity notice are specifically excluded from such a solicitation then the Coalition would strongly endorse the adoption of this recommendation already adopted by the House of Representatives.

With respect to on-going negotiations with those nine projects already selected by the DOE we would call to the Committee's attention a requirement of the program which may cause considerable delay in final agreements. That requirement, which was included in the general provisions of the law appropriating funds for the clean coal program provides, in part, that:

> "any contract, agreement or provision thereof entered into by the Secretary pursuant to this authority shall not be executed prior to the expiration of 30 calendar days (not including any day in which either House of Congress is not in session because of adjournment of more than three calendar days to a day certain) from the receipt by the Speaker of the House of Representatives and the President of the Senate of a full and comprehensive report on such project..."
>
> (see: Public Law No. 99-190, Joint Resolution Making Further Continuing Appropriations for the Fiscal Year 1986, and for Other Purposes; Department of Energy, Administrative Provisions)

The Congress is likely to adjourn sine die sometime next month and may not reconvene until a new Congress is seated in 1987. In that case, many projects may be delayed. This Committee is urged to seek removal of that program requirement. If the Congress requires additional information about selected projects or about contract negotiations with those projects then some other mechanism that will not jeopardize the timely conclusion of negotiations should be implemented.

IMPACT OF ACID RAIN CONTROL LEGISLATION AND THE DREW LEWIS REPORT UPON CLEAN COAL:

The principal organizing premise of the CCTC is the accelerated development, demonstration and, thereafter, widespread utilization of clean coal technologies. While some members are directly and vitally involved in the current debate over acid rain control legislation, the Coalition itself has steadfastly attempted to remain outside of that debate. We have concluded, however, that passage of acid rain control legislation which mandates major, near-term reductions in SO2 and NOx emissions, could jeopardize clean coal technology development. The capital requirements of compliance with proposed acid rain control legislation would be immense, and we are advised that any funds available for new technological development would be siphoned off to ensure compliance with the regulatory program. Other projected impacts have been documented elsewhere.

Within the timeframes mandated for those emission reductions required in pending acid rain control legislation it now appears that flue gas scrubbing systems would be widely used because no other cost effective clean coal technologies are yet commercially available. Emerging clean coal technologies promise to provide more and, perhaps, better alternatives than these already available systems. From the standpoint of effective emissions control the preferable public policy should be to ensure the development of technologies that are capable of least cost controls and maximum environmental benefit.

Proponents of acid rain control legislation contend that some emerging technologies may be sufficiently demonstrated in the early 1990's and they conclude that such technologies then could be used to comply with requirements for additional reductions which would be mandated by the mid-1990's.

The demonstration of new technologies simply takes time and, even if demonstration programs are successfully accelerated to the early 1990's, it appears that the utility industry will be unable to commit, plan and fully incorporate these technologies into their systems much before the turn of the century. In addition, those technologies which promise maximum environmental benefit will not have been fully demonstrated and available for commercial applications during the timeframe of proposed emission reductions.

In the process of making expenditures to comply with a control program the utility industry will use limited funds to meet any mandated emission reductions. Further, we are told that many electric utilities are likely to seek compliance of a unit just once, not twice. In other words, a utility in 1986, if control legislation were adopted, will examine its options for compliance to the most rigorous requirements of the law and then plan to comply a unit at one time to the strictest reductions. This means in many cases that interim compliance steps will not be taken as suggested by some proponents of acid rain control legislation. Whatever strategy various utilities adopt to comply with a new emissions control program, it is the concern of the Coalition that there may be little or no funds available to also develop new technologies during the early or late 1990's. At best, mandatory reductions will severely limit the number of new clean coal technologies that will be developed.

Finally, if a utility were to use a new technology without a vendor guarantee or if a utility were to risk incorporating the technology into a system before commercial readiness is proven and a failure were to occur, that utility might well be judged imprudent by the governing regulatory body. The risks of such a venture are too great and the rewards too small. Incorporation of a new technology before it is proven is simply not a proper course to pursue.

In March of this year the President and the Prime Minister of Canada endorsed the Report of the Special Envoys on Acid Rain. The principal recommendation of that report was the commitment to and initiation of a five billion dollar and five year program to develop innovative emission control technologies.

This report, while endorsed after enactment of the clean coal program, suggests an approach that may be more sensible and orderly for purposes of emission control should the Congress deem such controls to be appropriate. Although the objectives are not wholly consistent, the current clean coal program, with its emphasis on accelerated technology development, clearly complements the findings of the Report that emission control technologies must be rapidly pursued in a cooperative endeavor between government and the private sector.

RECOMMENDATIONS TO THE COMMITTEE ON SCIENCE AND TECHNOLOGY:

Emerging clean coal technologies are clearly in the best interest of the United States. Successful demonstration and then widespread utilization of these technologies will ensure that the environment is protected, that consumers are provided with reliable and least cost electricity and that our nation's most abundant fossil fuel resource -- coal -- is wisely and extensively used. From an energy, environment and economic perspective, clean coal technologies promise to be far superior as alternatives to current control technologies and every effort should be made to accelerate demonstrations and ensure widespread commercial use.

We urge the Subcommittee to consider the following recommendations:

1. Congress should adopt the recommendations contained in the recently passed Interior and Related Agencies Apppropriations bill for F.Y. 1987 (H.R. 5234) which directs the DOE to conduct another solicitation for statements of interest from industry to cost-share clean coal technologies meant to retrofit, repower or modernize existing facilities.

2. As a part of the solicitation for retrofit technologies the Congress is also urged to accept the Committee report language already adopted by the Senate Appropriations Committee which attempts to limit the requirements which DOE might otherwise place upon prospective project proposers. It is very important that industry receive a positive message. After the first solicitation there is considerable skepticism on the part of industry.

3. Once industry has responded to the statement of interest solicitation then the Congress might have a substantive basis upon which to determine the appropriateness for additional funding out of the Clean Coal Technology Reserve. The Coalition supports the appropriation of the entire $750 million and believes that the development of clean coal technologies warrants this magnitude of commitment from the federal government.

4. The requirement that agreements between project sponsors and the DOE must lie before the Congress for thirty days, when Congress might adjourn in the near future until 1987,

may seriously delay the program and the Congress is urged to re-examine and change this requirement. Further, the Congress is urged to monitor the negotiations between selected projects and the DOE to assure the timely completion of negotiations and to make certain that DOE requirements, including those for repayment, do not prevent the timely consummation of agreements.

5. If the United States is to receive the maximum benefit from a successful demonstration program, then the Congress and the Administration should also immediately examine the extent, if any, to which regulations must be changed and other financial incentives enacted to ensure the widespread use of technologies once demonstrations are completed. One of the most significant impediments to widespread use of new technologies is the uncertainty in which industry must now operate. Anything accomplished today to eliminate regulatory or financial uncertainty will better ensure the widespread use of commercially-demonstrated technologies tomorrow. We recommend that this Committee assist in initiating an examination of all available means by which to enhance the prospects for the marketplace to adopt these new technologies. The Clean Coal Technology Coalition has recently embarked upon an examination into those changes, including legislation and other reforms which we believe must be made in order to ensure that successfully demonstrated technologies will not simply be shelved. On behalf of the Coalition we would be pleased to work with the Committee on this important matter.

6. Finally, if current acid rain legislation were to be enacted, the Congress should be mindful that the full range of emerging clean coal technologies cannot be developed, demonstrated and made commercially available within the timetables for mandatory reductions now under discussion.

We need support from the Federal government to share in the risks of development and we need time and a favorable climate where government is a partner in development, in order to perfect and then to commercialize these new technologies. Congress has taken the lead in this important endeavor and industry is looking to the Congress for that additional support needed to assure the success of the clean coal program.

CLEAN COAL TECHNOLOGY COALITION

MEMBERSHIP

August 6, 1986

Allied-Signal, Inc.
Amax Coal Company
American Electric Power Service Corporation
Babcock & Wilcox
Baltimore Gas & Electric Company
Centerior Energy
Consolidation Coal Company
Edison Electric Institute
Florida Power & Light Company
General Electric Corporation
General Public Utilities, Inc.
Gilbert/Commonwealth
Illinois Power Company
Indianapolis Power & Light
Industrial Fuels Corporation
Island Creek Corporation
Jersey Central Power & Light Company
Madison Gas and Electric Company
Marietta Coal Company
Metropolitan Edison Company
MHD Development Corporation
Missouri Public Service
National Coal Association
Ohio Edison
Peabody Holding Company, Inc.
Pennsylvania Electric Company
Public Service Company of Indiana
Public Service Electric & Gas
South East Coal Company
Southern California Edison
Southern Company Services
Stone & Webster
The State of Illinois
The State of Minnesota
The State of Ohio
The Valley Camp Coal Company
TRW, Inc.
Union Electric Company
United Coal Company
West Virginia University
Wisconsin Electric Power Company

Mr. FUQUA. Mr. High.

STATEMENT OF MICHAEL D. HIGH, DIRECTOR, ENERGY DEMONSTRATIONS AND TECHNOLOGY, TVA

Mr. HIGH. Thank you, Mr. Chairman. I am Michael High, Director of the Energy Demonstrations and Technology Division of the Tennessee Valley Authority. I appreciate the opportunity to make this statement before your committee.

TVA is one of the largest coal-burning utilities in the United States and a recognized leader in clean-coal technology development, and as such, we feel uniquely qualified to make a statement regarding the Clean Coal Technology Program. TVA appreciates the Congress' recognition of the importance of advancing a wide variety of clean-coal technologies which can be cost-effective in meeting the national air standards as they now exist or may be modified. Even with a healthy nuclear industry, the United States will continue to be heavily dependent on coal for future electricity needs.

Since the early 1970's, we have conducted research on technologies directed toward removing SO_2 and have thousands of hours of operating experience on both full-scale, wet limestone scrubbers, and research facilities studying basic technology refinements to those systems as well as dry lime scrubbers. As a point of fact, we are now putting in place a 10-megawatt, research facility at our Shawnee steam plant to do further development work on the dry lime scrubbing system. We have invested nearly $8 million in this facility, and are finalizing commitments from Ontario Hydro in Canada and the Electric Power Research Institute to cofund a 3-year test program.

Additionally, along with EPRI we have begun the development of atmospheric, fluidized-bed combustion for utility applications in the early 1970's. This effort, along with the Department of Energy, Commonwealth of Kentucky, Duke Power Co., and several other electric utilities and many of the coal companies from the coal industries has led to the start of construction of 160-megawatt demonstration plant at our Shawnee steam plant in Paducah, KY.

This and two other full-scale AFBC demonstrations, one of which is in startup today, are being conducted nationally. We feel comfortable about the future of AFBC technology and do not believe it requires any further Federal funding. In fact, some electric utilities are in the process of placing commercial orders for AFBC units to repower existing fossil generation. There will be AFBC plants built for repowering and retrofits where the economics favor its application. Additionally, that retrofit application is environmentally attractive with respect to high sulfur removal as well as the control of nitrogen oxides [NO_x] since it is inherently a low NO_x emitter when compared to conventional combustion processes.

In summary, we believe the fluid bed, combustion process, along with wet limestone scrubbing systems and, of course, the option of burning low-sulfur coal are in, or will be in our clean-coal technology picture in the 1990–94 timeframe.

Because the options described above may not be the most cost-effective for a given plant location or fuel supply, we believe the

DOE clean-coal technology should focus on retrofit technologies on a scale large enough to give the electric utility industry the confidence to buy commercial systems if and when they are needed. A point of fact is that the electric utilities in this country burn 80 to 85 percent of the Nation's coal and will probably continue to do that. To bring a capital-intensive technology to commercial acceptance requires operation for several years of one or more units at a scale representative of full scale.

The general guidelines for the clean-coal technology projects set forth in several Senate and House of Representatives reports clearly recognize the necessity for demonstrating commercial feasibility. Of the nine initial projects selected by DOE's Clean Coal Technology Program, three projects would demonstrate a near-term, retrofit technology for the electric utility industry. Those are the limestone, injection, multistage burner with an induct injection process; advanced, air-cooled, cyclone combustor; and a combination of gas-reburning and sorbent injection process. The proposal abstracts that we have indicate the scale of these retrofit projects would range from 105 megawatts down to a 1-ton-per-hour, coal combustor. Two appear to be adequate for a full-scale demonstration.

A major factor in the selection of the clean-coal technology is, of course, its ability to comply with the requirements of the Clean Air Act. The selected projects which are designed to demonstrate mostly a grassroots application, such as pressurized, fluidized bed, coal liquefaction, and integrated coal gasification combined cycle, should be capable of meeting new source, performance standards. However, all the selected retrofit technologies have a SO_2 removal potential of only 50 to 60 percent while at least a 70- to 80-percent removal will be required to meet a 1.2-pound standard while burning medium- to high-sulfur coal. If a 1.2-pound-standard were a part of an amendment to the Clean Air Act, TVA and many other utilities would find limited applications of the LIMB and other sorbent injection technologies.

Keeping in mind the critical question of the availability of clean coal technologies, we have in the past reviewed the initial commercial operations of several technologies. Our overall projection is that the selected retrofit technologies could be commercially available by the mid-1990's, while the grassroot technologies probably will not available in large quanitities until after the year 2000.

The probability of technical and economic success and ultimate commercial replication of each selected project is difficult to assess. Our preliminary assessment is that the only three selected retrofit technologies have a reasonable probability of technical success on a first time through, thus allowing a commercial replication by the 1990's.

As a result, significant environmental benefits are not expected to materialize until after the year 2000 on the grassroot-type facilities. Such technology probably will be incorporated in new plants to comply under new source standards. Some may also be required to meet more stringent emission standards in given locations of the United States.

Economic feasibility should be a continuing factor in the selection of the clean coal technology program. In general, several of the initial selections, such as underground coal gasification and coal liquefication received unfavorable economic evaluation under commercial market conditions by the Synthetic Fuels Corp. The economic viability of these technologies could be equally difficult to achieve under the clean coal technology program.

The primary focus of the clean coal technology, then, should be retrofit applications with emphasis on coal-fired electric generating systems. However, the program guidelines provided to the proposers did not specifically recommend retrofit applications over new applications. Of the 13 examples given for emerging clean coal technologies, less than half were generally applicable to retrofit cases. Consequently, the vast majority of proposals received by the Department of Energy related to new or long-term applications, and the subsequent selected process include only three retrofit technologies. It is obvious to TVA that more emphasis should have been placed on the retrofit technologies.

In a broad sense, all the clean coal technology projects could be appropriate for acid rain control. However, if acid rain control legislation requires near-term decisionmaking, that is, emission reductions in the early to mid-1990's, some of the proposed technologies probably could not be applied since it could be many years before they are commercially available.

In summary, we believe that the coal technologies should be developed. However, an appropriate mix of near-term and long-term technologies should be funded with more emphasis on the retrofitting of electric generation plants. Techniques such as underground coal gasification, while viable in the long term, cannot be developed in a time to significantly mitigate the environmental impact of coal use for the next 15 to 20 years. Finally, the success of the gasification- or liquefication-type processes depend directly on the world energy prices. That in itself makes the timing of their implementation extremely uncertain.

Thank you.

[The prepared statement of Mr. High follows:]

STATEMENT OF

MICHAEL D. HIGH
DIRECTOR OF ENERGY DEMONSTRATIONS AND TECHNOLOGY
TENNESSEE VALLEY AUTHORITY

BEFORE THE

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

SEPTEMBER 10, 1986

Mr. Chairman, I am Michael D. High, Director of the Division of Energy Demonstrations and Technology of the Tennessee Valley Authority. TVA is one of the largest coal-burning power producers in the United States and a recognized leader in developing clean coal technologies. As a corporate agency and instrumentality of the United States Government created under the TVA Act of 1933, which provides for TVA to produce, distribute, and sell electric power at the lowest feasible rate, as well as further the proper use, conservation, and development of the natural resources of the region and provide for the general welfare of its citizens, TVA is uniquely qualified to submit the following statement regarding the Department of Energy's (DOE) clean coal technology program.

TVA appreciates Congress's recognition of the importance of advancing a wide variety of clean coal technologies which can prove cost effective in meeting clean air standards as they currently exist or as they may be modified in the future. Even with a healthy nuclear electricity generating option, the United States will continue to depend heavily on coal to meet future electricity needs.

Since the early 1970s, TVA has conducted research on technologies directed toward removing sulfur dioxide (SO_2) from utility power plant flue gases. Several thousand hours have been accumulated at TVA prototype research facilities studying basic wet limestone scrubbers, refinements to those systems, and dry lime scrubbers. A new dry lime scrubbing research and development facility at a size equivalent to 10 MW electric will begin operating at our Shawnee Steam Plant in Paducah, Kentucky, by the middle of this month. TVA has invested nearly $8 million in the facility, and we are finalizing commitments from Ontario Hydro in Canada and the Electric Power Research Institute (EPRI) to cofund a 3-year test program by which we look forward to producing an abundance of useful information.

Additionally, TVA began the development of atmospheric fluidized bed combustion (AFBC) for electric utility applications in the late 1970s, and, to date, has several million dollars invested in the technology. This effort, along with EPRI, DOE, Commonwealth of Kentucky, Duke Power Company, and a host of other electric utilities, coal companies, and railroads, and the coal industry in general, has led to the construction of TVA's 160 MW AFBC Demonstration Plant Project at Shawnee Steam Plant in Paducah, Kentucky. Two other full-scale AFBC demonstrations, one of which is in startup today, are being conducted nationally. We feel comfortable about the future of AFBC technology and do not believe it requires any further Federal funding support. In fact, some electric utilities are in the process of placing commercial orders for AFBC units to repower existing fossil generation. There will be new AFBC plants built along with repowering and retrofits where the economics favor its application. Retrofit with an AFBC boiler is environmentally attractive with respect to high SO_2 removal efficiency (85 to 95 percent) and the control of nitrogen oxides (NO_x) since it is inherently a low NO_x emitter when compared to most combustion processes. In summary, we believe that AFBC, along with scrubbing systems and the burning of low sulfur coal, are in or will be in the clean-coal technology picture in the 1992 to 1994 time period.

Because the options described above may not be the most cost effective for a given plant location and fuel supply, TVA believes the DOE clean coal technology program should focus on retrofit technologies on a large enough scale to give the electric utility industry the confidence to buy commercial systems if and when they are needed. To bring a capital-intensive technology to commercial acceptance requires operation for several years of one or more units at a scale representative of a full scale. Design, construction, and operation of mechanical equipment representative of full scale give the potential users the information necessary to estimate costs associated with needed investment capital, maintenance, and reliability. Large-scale demonstration of emission-control technologies also verifies the efficiency of pollutant removal, a critical factor in formulating low cost control strategies.

The general guidelines for clean coal technology projects set forth in Senate Report 99-82 clearly recognized the necessity for demonstrating commercial feasibility. Of the nine initial projects selected by DOE's clean coal technology program, three projects would demonstrate a near-term, retrofit technology for the electric utility industry--the limestone injection multistage burner (LIMB)/induct injection process; advanced, air-cooled, cyclone combustor; and a combination gas-reburning and sorbent-injection process. The proposal abstracts indicate that the scale of these retrofit projects range from 105 MW for the limestone injection multistage burner project to a single 1-ton/hr coal combustor for the advanced-combustor project.

The scale of the remaining longer term technology projects fall in the 5- to 70-MW size range. While the scale of the LIMB project and the gas-reburning project (up to 117 MW) should be of sufficient size to provide commercial cost and performance data, the remaining projects may not be large enough to adequately address full-scale cost and performance issues. A successful commercial demonstration of the selected technologies would require them to meet the previously discussed cost, reliability, and efficiency criteria before being commercially viable.

A major factor for selection of a clean coal technology is, of course, it's ability to comply with the requirements of the Clean Air Act. The selected projects which are designed to demonstrate new applications, such as pressurized fluidized bed combustion, coal liquefaction, and integrated coal gasification combined cycle (IGCC) systems, appear to be capable of meeting new source performance standards. However, all the selected retrofit technologies have a SO_2 removal potential of only 50- to 60-percent while at least 70- to 80-percent SO_2 removal would be required to meet a 1.2 lb $SO_2/10^6$ Btu standard while burning medium- to high-sulfur coals. If a 1.2 lb $SO_2/10^6$ Btu standard were adopted as part of the amendments to the Clean Air Act, TVA and many other utilities would find limited application of the LIMB and other sorbent-injection technologies.

Keeping in mind the critical question of the availability of clean coal technologies, TVA has in the past reviewed the timing of the initial commercial operation of several technologies. In general, we have assumed a 2- to 3-year successful demonstration followed by a minimum of 4 to 5 years to plan, permit, design, construct, and start up the first commercial units. An optimistic projection follows:

Technology	Commercial Operation
o Coal/oil coprocessing	1994-1996
o Gas reburning and sorbent injection	1991-1993
o Underground coal gasification	2000-2005
o IG-STIG	1999-2005
o IGCC-Hot gas cleanup	1998-2000
o Kohle reduction	---
o PFBC	1998-2001
o LIMB/Coolside	1994-1996
o Advanced combustor	1992-1994
o AFBC - Bubbling	1994-1996
o AFBC - Circulating	1992-1994
o Dry lime scrubber	1992-1994

Our overall projection is that the selected retrofit technologies could be commercially available by the mid-1990s, while the new source technologies will not be available until after the year 2000.

The probability of technical and economic success and ultimate commercial replication of each selected project is difficult to assess. However, we are familiar with significant technical issues for each technology which must be resolved before the proposed demonstration can be considered a commercial success.

The technical uncertainties surrounding several of the selected technologies are clearly an indication of the difficulty involved in ultimately successfully demonstrating a commercial system. Several of the demonstrations are likely to leave certain technical issues unresolved, including those problems which will not be identified until the demonstration unit is operating. Our preliminary assessment is that only the three selected retrofit technologies--LIMB/Induct injection process; advanced air-cooled, cyclone combustor; and combination gas-reburning/sorbent injection--have a moderate probability of technical success, thus allowing commercial replication by the 1990s.

It appears most of the selected projects are applicable to new sources rather than for retrofit on existing sources. As indicated previously, the timing for construction of new plants is difficult to predict due to the changing nature of factors such as load demand and fuel prices. However, for the selected new source technologies, significant environmental benefits are not expected to materialize until after the year 2000. Such technology probably would be incorporated in new plants to comply with New Source Performance Standards, and some of the technologies also may be required to meet more stringent emission limitations that exist locally in some parts of the country.

In the absence of new regulatory requirements, it is conceivable that new SO_x control technology could be deployed on existing sources if the new retrofit technology is more cost effective than current provisions for compliance. For example, the installation of a lower cost SO_x control system for operation with high-sulfur coal could be more economical for an existing source than burning more expensive low-sulfur coal. Therefore, the deployment of the retrofit technology could potentially materialize without new regulatory requirements.

There are several retrofit technologies ready for prototype evaluations or demonstration projects; thus, in five to eight years several of the innovative technologies could be available if work were aggressively begun now. We believe that allowing for such development as a part of national acid rain control strategy could be beneficial.

In addition to AFBC and dry scrubbing, other clean coal technologies with promise of development within the 1990s might include advanced chemical and physical coal cleaning, precombustion controls, and advanced FGD systems, such as dual alkali systems.

Economic feasibility should be a continuing factor in the selection of the clean coal technology program. In general, several of the initial selections, such as underground coal gasification and coal liquefaction, received unfavorable economic evaluation under commercial market conditions by the Synthetic Fuels Corporation. The economic viability of these technologies could be equally difficult to achieve under the Clean Coal Technology Program.

General Commentary on the Clean Coal Technology Program's Effectiveness

At the present time there are two major options available for reducing sulfur dioxide emission rates to low levels (1.2 lb/10^6 Btu) at most coal-fired power plants--the use of low-sulfur coal and wet scrubbing. In the near term there are other options which have been shown to be technically feasible at the bench, pilot, and prototype levels but have not yet been shown to be economically competitive with limestone scrubbing through a full-scale demonstration. If the Clean Coal Technology Program is directed toward demonstrating such technologies over the next five to six years, one or more of them may become a viable option at some power plants for controlling SO_2 emissions. In the longer term, clean coal technology research and demonstration are critical in the development of more economical and efficient options for using coal to produce electric power in an environmentally acceptable manner.

The primary focus of clean coal technology should be on retrofit applications with emphasis on coal-fired systems. However, the program guidelines provided to proposers did not specifically recommend "retrofit" applications over "new" applications. Of the 13 examples given for emerging clean coal technologies, less than half were generally applicable to retrofit cases. Consequently, the vast majority of proposals received by the Department of Energy related to "new" applications, and the subsequent selected projects include only three retrofit technologies. It is obvious that more emphasis could have been placed on the retrofit need.

In a broad sense, all the proposed clean coal technology projects could be appropriate for acid rain control. For example, application of fuel cells could indirectly reduce SO_2 emission levels by forestalling the need to add more coal-fired generation capacity. However, if acid rain control legislation requires near-term decisionmaking (i.e., emission reductions in the early 1990s), some of the proposed technologies probably could not be applied since it could be many years before they would be commercially available.

In summary, we believe that new clean coal technologies should be developed. However, an appropriate mix of near-term and long-term technologies should be funded with more emphasis on retrofit. Techniques such as underground coal gasification, while viable in the long term, cannot be developed in time to significantly mitigate the environmental impact of coal use for the next 15 to 20 years. The success of gasification or liquefaction depends directly on world energy prices which makes the timing of their implementation extremely uncertain.

Mr. FUQUA. Thank you very much.
Mr. Yeager.

STATEMENT OF KURT E. YEAGER, VICE PRESIDENT AND DIRECTOR, COAL COMBUSTION SYSTEMS DIVISION, EPRI

Mr. YEAGER. Thank you, Mr. Chairman, members of the committee. I am Kurt Yeager, vice president and director of the Coal Combustion Systems Division of the Electric Power Research Institute.

I appreciate this invitation to again meet with the committee to discuss the Department of Energy's Clean Coal Technology Program and its implications for electricity supply and environmental improvement. The program is especially significant to the electric utility industry, and therefore is of great importance to the Electric Power Research Institute.

As we achieve a growing understanding of the complex interaction among pollutants, the results indicate that the Nation should be concentrating on developing an effective sustained strategy to continue the substantial progress that has been made in all aspects of emission control. In this it is in our judgment especially important to apply vigorously the new clean coal technologies that combine emission control with the combustion or conversion process. We are very pleased that in the recommendations of the joint report of the special envoys on acid rain, the Lewis-Davis report, that this approach and philosophy was reflected.

As part of the effort to advance the use of clean coal technology, EPRI and others in the utility industry recommended an accelerated national program to better understand first the environmental issues constraining the use of coal and to demonstrate and promptly apply promising new clean coal technologies. The effort would build on activities that were already well underway within the Federal and private sectors.

I think it is important to note in this that after careful consideration a variety of the people whose judgment was sought, all concluded that a cost-shared program involving $750 million in Federal funding was the recommended level of effort in order to achieve this kind of a balanced program, and I believe this recommendation remains valid.

I would like to comment today on, really, three areas that the committee asked: First, some of the objectives relative to clean coal development; second, our observations concerning the solicitation as it stands to date; and recommendations concerning further efforts in this area.

First, with respect to clean coal development objectives, the principle which has guided clean coal technology development has been that sustained environmental improvement can only be realized when both emission and cost reductions are achieve concurrently, not pitted against each other, as is the case we find all too often today. This is particularly important to the electric utility industry which utilizes over 80 percent of the coal being produced in the United States annually. New power generation options which can meet increasingly stringent siting and environmental demands without sacrificing productivity and can be rapidly constructed in modular fashion over a range of sizes are particularly in demand.

The next 10 years will therefore be of paramount importance both in assuring future electricity supply and in controlling costs. It is in the strategic interests of the utility industry, the environmental community and the Government alike to assure the success of this national program which affects not only the use of coal but, I think more importantly, national economic competitiveness and our ability to sustain our economic base.

In order to reduce the disadvantages facing conventional coal-fired plants, clean coal technology development has pursued two primary objectives. I think it's important to underscore these because there tends to be some confusion between them. First, to provide an array of retrofittable emission control options which satisfy at reduced cost the large void between present physical coal cleaning capabilities and flue gas scrubbing for existing powerplants. This is both to protect the productivity of existing capacity in the event that further environmentalal controls may be required. Second, and we think strategically most important, is to provide improved coal utilization alternatives for both repowering and new plant applications which would combine both high levels of emission and effluent control with reduced cost and improved thermal efficiency. Those are both complementary and areas of technology which should be addressed carefully during the course of this kind of a program.

We believe, in both cases, the key question which must be resolved before a large-scale application can occur is proof of their long-term reliability under the utility operating conditions, and this is the area that the clean coal program has proposed to stress, and take advantage of the many developments that have been brought forward over the last decade through the leadership of the utility industry and its suppliers. Most particularly I think it's important to point out that the successful cool-water integrated gasification combined cycle and the three atmospheric fluid bed combustion demonstrations being led by the utility industry and the Electric Power Research Institute provide effective models for these demonstration efforts.

With respect to observations regarding the first, the solicitation effort and selection process to date, I would comment on the following conclusions. We concluded, with respect to the objectives of the congressional program that although there were valuable opportunities included among the projects awarded by DOE in July of this year they will not be sufficient to meet the objectives of the congressional clean coal technology initiative.

Second, it is evident that the procurement conditions and information requirements of the Program Opportunity Notice tended to confuse and discourage many important clean coal demonstration proposals. As a result, the program opportunity notice predestined a project selection which could only address a portion of the balanced and logical program necessary to enhance clean coal utilization. We find of particular concern the very limited opportunity among the awards made to demonstrate promising lower cost, clean coal technologies for retrofitting and repowering existing coal-fired plants.

With respect to recommendations concerning a second solicitation, I would make four points. First, I think the philosophy of project selection should reflect DOE's role as primarily an expediter of technology for use by the private sector. DOE will not be the user or purchaser of the commercial projects resulting from this program, and its selection and procurement processes should better reflect this distinction.

Second, the information requirements of the Program Opportunity Notice should be substantially reduced to reflect the realities of the technologies being selected.

Third, the selection criteria should reflect the importance to Congress and the Nation of demonstrating technologies that can be applied on a retrofit basis to the existing generating capacity in the United States.

And, fourth, the requirement for repayment should be clarified and there should be absolutely no ambiguity concerning these requirements for repayment of assistance.

Several projects identified by the Department of Energy in their published backup list of 14 projects proposed under the program opportunity notice, in our judgment, merit support to partially fill the gap left by the initial selection. These include, and these are in no particular order: One, the turbocharged pressurized fluidized bed retrofit proposed by the Wisconsin Electric Power Co., and this would provide a valuable complement to the American Electric Power project and would closely correlate with the philosophy of the industry with respect to atmospheric fluid bed combustion; two, combustion clarification and qualification of clean coals; three, the lime spray dryer retrofit program proposed by TVA; four, the cleaning and upgrading of low-ranked coals; five, microbubble flotation for coal cleaning; six, indirect coal liquefaction with integrated gasification combined cycle; and, seven, the circulating AFBC retrofit—involvement there by DOE similar to that which they have currently with the TVA/Duke Power/State of Kentucky AFBC demonstration.

We also believe a short form solicitation should be initiated which targets the additional retrofittable control technology demonstrations which were confused and discouraged under the original Program Opportunity Notice. Technology areas which we believe should be emphasized would include the varieties of dry sorbent SO_2 control, combustion and postcombustion NO_x control (as this element of emissions becomes more and more important in our understanding of the environmentalal implications of coal use), advanced wet-scrubbing technologies that would reduce the cost and improve the reliability, and improved physical, chemical, and biological coal cleaning.

We believe also that the project selection, in terms of meeting the objectives of the congressional clean coal initiative, would be enhanced by an advisory structure empowered to assist DOE with business and technical guidance that would involve both other Government agencies as well as the private sector.

The inflexibility of proposed legislation which is intended to further reduce emissions also, in our judgment, tends to discourage the application of innovative clean coal technology and limit freedom of choice in this area. Instead of advancing the improvement of the environmental, we believe that the result may be to substantially increase the cost of compliance and delay implementation of new clean coal generating capacity which combines emission control and cost reduction. The result would be eroding environmental quality and economic productivity, quite contrary to the expectations of the legislation.

Finally, the future for Clean Coal Technology is now. Success depends on prompt aggressive action by Government and industry. We believe the Clean Coal Technology Program supporting private sector demonstration initiatives can substantially enhance the Nation's ability to commercialize and apply the many developments in clean coal technologies. And we, the Electric Power Research Institute, are prepared to continue to do our part in supporting these efforts.

Mr. Chairman, and committee, I thank you very much.

[The prepared statement of Mr. Yeager follows:]

STATEMENT OF

KURT E. YEAGER
VICE PRESIDENT, COAL COMBUSTION SYSTEMS DIVISION
ELECTRIC POWER RESEARCH INSTITUTE

Before The
Subcommittee on Energy Development and Applications
Committee on Science and Technology
U.S. House of Representatives

September 10, 1986

INTRODUCTORY STATEMENT

Mr. Chairman, Members of the Committee: I am Kurt E. Yeager, Vice President and Director of the Coal Combustion Systems Division of the Electric Power Research Institute (EPRI).

I appreciate this invitation to discuss the Department of Energy's (DOE) Clean Coal Technology Program and its implications for electricity supply and environmental improvement. This program is especially significant for the electric utility industry, and therefore is of great importance to the Electric Power Research Institute.

EPRI was established by the electric utility industry in 1972 to conduct a broad research and development program for the entire electric utility industry and its ratepayers. EPRI's R&D mission is to develop new and improved technologies for electric power production, delivery and use, and to help accelerate their availability insuring an adequate supply of economic, reliable and environmentally acceptable electricity.

EPRI is supported by voluntary contributions from investor-owned, government-owned and cooperatively-owned electric utilities across the nation. Over one-third of EPRI's planned budget in the next five years will be directed to clean coal technology. This is an addition to the $700 million already invested by EPRI on this effort. This commitment is based on the premise that coal utilization and environmental protection are mutually compatible and that improved technology is the key to compatibility. Sound scientific data derived from independent, peer-reviewed research must be developed in a timely manner on topics of environmental concern. In addition, information is required to reliably apply the most cost-effective clean coal technologies meeting the diverse needs of the utility industry.

Current environmental control capabilities must be improved by reducing capital and operating costs and preserving overall plant productivity. The importance of this effort is underscored by the fact that a new, large, conventional coal-fired power plant will typically cost $1.5 billion, with over 30% of this cost being directed toward environmental control. This includes sulfur dioxide (SO_2) scrubbing, particulate control, solid waste disposal, water treatment and plant cooling. These controls in their current form also have a major impact on plant efficiency and reliability.

The emission control debate has been driven by conflicting perceptions about the effectiveness of clean air programs. During the past decade these programs nationwide achieved a 20% reduction in SO_2 emissions while utility coal use increased 70%. In addition, EPRI analyses conclude that SO_2 emissions will continue to decline under the existing Clean Air Act. In spite of the progress achieved, the political focus is shifting from new sources to the more difficult problem of existing facilities. In essence, the debate concerns which sources should be required to further control emissions, by what means, and at whose expense.

The growing understanding of the complex interaction among pollutants indicates instead that the nation should be concentrating on developing an effective, sustained strategy to continue the substantial progress made in all aspects of emissions control. Especially important is vigorous application of new, clean coal utilization technologies that combine emission control with the combustion or conversion process. The utility industry has led the nation in developing and applying clean coal technology, thus strengthening the likelihood of using coal cleanly in every respect this century.

Recommendations in the recent "Joint Report of the Special U.S./Canadian Envoys on Acid Rain" (The Lewis/Davis Report) reflects this change. First, environmental protection can best be achieved through use of innovative clean coal technology rather than ineffective, "band-aid" plant modifications that compromise both productivity and the environment. Second, accelerated commercial demonstration and implementation of these technologies by regulated utilities will require cost-sharing and other incentives not available today. Third, continued research is required in the ecological and atmospheric sciences to better understand cause and effect relationships.

This is a symbolic change in approach and one which provides an opportunity for a positive solution, building on the utility industry's sustained commitment to resolution of the environmental and economic productivity challenges facing the nation.

Since its inception, EPRI has worked with the Department of Energy (DOE) and its predecessor agencies, the Environmental Protection Agency, and other Federal agencies with energy research and development responsibilities to achieve mutual technical objectives. In the spirit of that long-standing cooperation, EPRI and others recommended an accelerated national program to better understand the environmental issues constraining the use of coal and to demonstrate and promptly apply promising new clean coal technology. This effort would build on activities already underway within the federal and private sectors. It recognizes that a major pacing issue in commercial applications of the new clean coal technologies developed over the past decade is the magnitude of the resources necessary to confidently demonstrate their performance and reliability. This requires an intensive, joint effort by industry and government. My remarks today focus on three principal aspects of this national Clean Coal Technology program; viz.,

1. Clean coal development objectives.
2. Observations regarding the first DOE Clean Coal Technology solicitation.
3. Recommendations concerning a second solicitation.

CLEAN COAL DEVELOPMENT OBJECTIVES

The principle which guides clean coal technology development is that sustained environmental improvement can only be achieved when both emission and cost reduction are achieved concurrently, not pitted against each other. Recognizing this principle, the utility industry stands at a threshold of fundamental change in its technological base for power generation. The present commercial coal-fired technology is nearing the end of its development potential and is hard-pressed to respond effectively to the rapidly changing requirements being placed on power plants. New power generation options which can meet increasingly stringent siting and environmental demands without sacrificing productivity, and can be rapidly constructed in modular fashion over the range of unit sizes are particularly in demand. The next 10 years will therefore be of paramount importance, both in assuring future electricity supply and in controlling cost. It is in the strategic interests of the utility industry, the environmental community, and Government alike to assure the success of this national program.

These changing institutional constraints have effectively priced new conventional coal-fired generating capacity out of the market for most utilities. For example, it costs three times more today in constant dollars to install a kW of conventional coal-fired electric generating capacity than in 1967. Only a fundamental improvement in power plant technology can effectively respond to these growing constraints on coal-fired power generation and restore economic progress in electricity production. Failure to meet this challenge will not only sacrifice environmental protection but will undermine national economic competitiveness leading to further erosion of industry and jobs.

The urgency of this joint commitment is underscored by the rapidly approaching challenge to the nation's electricity supply capability. Based on recent experience, we can expect electricity demand to continue to pace economic growth. Satisfying even modest growth during the remainder of the century will require a balanced strategy involving additional improvements in conservation and end use management, greater productivity from existing generation capacity (reliability, heat rate and life extension), plus new generation capacity.

New clean coal technology now under development could reduce the cost of this necessary capacity expansion by more than 50% relative to current experience. The industry's present, temporary, capacity margin provides a valuable window of opportunity for technical transition at minimal risk. The new clean coal technologies can now be introduced through incremental, small scale additions, repowering of existing units, "off-balance sheet" plants, and PURPA cogeneration opportunities. The rate of capacity expansion for the late-1990s and beyond cannot, however, be achieved without advancing the technology to much larger scale additions. It is therefore essential that this present opportunity be used to gain the experience and confidence necessary to meet the future capacity expansion challenge.

In order to reduce the disadvantages facing conventional coal-fired power plants, clean coal technology development in the United States has pursued two primary objectives; viz., to

A. Provide an array of retrofittable emission control options which satisfy, at reduced cost, the void between present physical coal cleaning capabilities and flue gas scrubbing for existing power plants.

B. Provide improved coal utilization alternatives for both repowering and new plant applications. These combine high levels of emission and effluent control with reduced costs and improved thermal efficiency.

An important distinction should be recognized between these two objectives and the technologies they represent. The second has the potential to reduce the absolute cost and increase the productivity of power generation. The first objective can only limit the cost increase which would otherwise be imposed by more expensive retrofit controls.

Under objective A, the inefficiencies and costs of current flue gas desulfurization technology coupled with the uncertain possibility that existing plants may require retrofitting of emission controls leads to the need for additional, simplified emission control options. These range from improved physical coal cleaning to combustion modification, furnace sorbent injection, partial and dry scrubbing, and low NO_x combustion. No single one of these options will satisfy the widely varying conditions in the range of existing coal-fired utility and industrial power plants. As a group, however, then can reduce the cost and productivity limitations of emission control today. Depending on regulatory requirements, the United States market for such retrofittable emission control options could be as much as 170,000 MW during the 1990s alone.

Selection will depend on a number of variables including control requirements, cost and functional criteria such as plant design and space limitations. Functional criteria can be a particularly important constraint when considering retrofit to existing plants. Unlike new plants where the boiler and emission controls can be designed as an integrated unit, retrofit requires adaptation on to a plant not designed for such modification. Nevertheless, they can become particularly valuable in the event emission control on existing high sulfur coal plants is required. The potential for 50-70% SO_2 reduction is attractive under these circumstances.

EPRI has examined a variety of emission reduction requirements in terms of the potential savings achievable through optimal use of this array of new retrofittable technologies. In each case, capital and annualized costs were reduced from 40% to 70%. Unfortunately, the legislative and regulatory proposals developed thus far in the United States fail to provide the flexibility necessary to fully implement these opportunities, thus effectively limiting utilities to either scrubbing or retiring the majority of their units. A requirement to apply current flue gas scrubbing technology to existing units would impose an additional cost of nearly $300/kW and would force many units into retirement at a time when their power generation capability will be increasingly important to the reliable supply and cost of electricity.

Objective B, the use of new coal utilization technologies such as atmospheric fluidized bed combustion (AFBC), pressurized fluidized bed combustion (PFGBC), and integrated gasification combined cycle (IGCC) has the potential to be more effective both in terms of environmental control capability and cost. These technologies combine emission control within the combustion or conversion process, rather than adding new process complexity. The result is both greater emission control efficiency and improved generation productivity to fundamentally resolve perceived conflicts between energy and the environment. As a result, they are a more effective use of national resources than additions of flue gas desulfurization systems to existing coal-fired capacity. This underscores the value of economic and regulatory incentives that emphasize prompt transition to these improved coal utilization options rather than diverting resources into "band-aid" retrofit efforts.

The key question which must be resolved before large scale application of these options can occur is proof of their long-term reliability under utility operating conditions. The EPRI program, therefore, stresses the development and demonstration of these options at sufficiently large scale to verify their commercial reliability. In the absence of broad government participation in these large, capital intensive projects, the burden of support falls today on the private sector.

The highly successful Cool-Water IGCC and the three AFBC demonstration projects being led by the utility industry and EPRI provide effective models for these technology demonstration efforts necessary to accelerate clean coal technology. EPRI has been pleased to be a partner and catalyst for these projects and looks forward to continuing its cooperative efforts, where possible, to stimulate the prompt acceptance of improved technology. Unfortunately, EPRI is able to fund less than half the scope of the program at a time when needs are increasing dramatically as a result of the industry's successful development efforts.

The strategic environmental advantages of the new clean coal technologies relative to conventional wet scrubbing are also substantial. Proposed acid rain control legislation -- that would retrofit flue gas scrubbers on up to 100,000 MW of existing, high sulfur coal-fired generating capacity -- could cost the nation as much as $12 billion per year over the remaining life of the affected plants. A more effective alternative would be to introduce new clean coal technologies that offer greater emission control efficiency and improved generation productivity.

If the $200 billion necessary to implement the scrubber retrofit strategy over the remaining life of the affected plants were instead invested on new plants using advanced clean coal technologies, it would provide about half of the new generating capacity the nation is likely to require during the next 30 years. Such an investment would provide superior environmental control, not only for sulfur oxides but also for nitrogen oxides and solid waste, while improving the productivity and cost of power generation.

Observations Regarding The First DOE Clean Coal Technology Solicitation

EPRI strongly endorsed the DOE Clean Coal Technology Demonstration program mandated by P.L. 99-190, for cost-shared demonstrations. This is one of the most essential ingredients today in accelerating the utilization of clean coal technology. We agreed with the intent of Congress that DOE's role be as a risk-sharing partner, not a loan office which would be of little value to the regulated utility industry who will lead many of these necessary demonstrations. Unfortunately, cost-sharing confusion caused by the February 17, 1986 DOE Program Opportunity Notice (PON), coupled with its unrealistic information requirements, has discouraged a number of potentially important utility projects. As a result, EPRI is concerned that the Department of Energy's implementation of P.L. 99-190 will not be adequate to achieve the Congressional objectives. Table 1 compares the projects identified to DOE in February 1985 with those actually received in April 1986, as well as selected in July 1986 for negotiation.

The following summarizes EPRI's assessment of the response to the PON relative to electric utility applications:

- The proposals submitted are less than one-third the number of clean coal demonstration projects identified to DOE a year ago (51 vs 175). Many were apparently cancelled because of the discouraging requirements in the PON relative to the private sector's understanding of the original Congressional intent.

- The areas of least response, both in terms of quantity and quality relative to the opportunities identified originally, appear to be the retrofittable emission control options, particularly lower-cost engineered plant modifications for both SO_2 and NO_x.

As seen in Table 1, the limitations predestined by the PON were further reinforced by the DOE project selection process. As a result, important and fully responsive demonstration proposals, particularly in fluidized bed combustion, coal preparation, and flue gas cleanup, were relegated to also-ran status. A simplified and unambiguous "short form" PON targeted on these gaps would encourage the retrofit emission control options which are notably absent in the response. These are especially important to reduce cost if further emission reductions become necessary for existing plants.

DOE also has a unique opportunity to work more closely with the private sector in resolving the various constraints, often resulting from governmental action, on the use of innovative technology. In this context, cofunding is only one way in which DOE can help. DOE should also lead, when opportunities arise, programs which could result in increased private sector R&D efforts and reduce the need for direct DOE involvement. For example, the state of Ohio has recently taken the initiative of funding clean coal technology demonstration programs in such a way that the industrial partners retain the commercial and managerial incentives. The state role is to promote demonstrations by sharing part of the cost and insuring a reasonable rate of return on the remainder by acceptance in the utility rate base.

This underscores the need for an effective coordination mechanism between federal and state governments to develop cost and risk-sharing incentives in as effective manner as possible, including assured cofunding for multi-year demonstration programs. The establishment of this coordination mechanism, for example, could be encouraged by a conference of governors from coal utilizing and coal producing states along with the heads of affected federal agencies. An industry task force also needs to be established that is empowered to provide combined business and technical judgment, guidance, and direction for the DOE Clean Coal Technology program. Such a panel could provide valuable input to the DOE and Congress in the prioritization and acceleration of clean coal technology having important commercial and environmental potential.

The importance of the DOE Clean Coal Technology program has been further underscored by the January 8, 1986 "Joint Report of the Special Envoys on Acid Rain." This importance remains largely unsatisifed for technologies which can span the gap between the available low removal efficiency SO_2 controls (such as existing coal cleaning) and high cost, high SO_2 removal technologies (such as wet scrubbing).

Retrofittable SO_2 and NO_x emission control technology demonstrations are essential to providing the electric utility industry with a range of cost-effective options in the event of acid rain legislation or additional requirements for life extended units. Proposed acid rain legislation calls for full program implementation in the mid to late 1990s. Given the time to adequately demonstrate such technologies and then apply them throughout the electric utility industry least 3 years will be required for demonstration and 6 to 10 years beyond that for retrofit. Therefore, if the nation is to respond effectively, it is imperative that DOE and the electric utility industry begin the required demonstrations promptly.

Recommendations Concerning a Second Solicitation

Several changes in the PON process could help bridge the gap that resulted from the first project selection process. First, the philosophy of project selection should better reflect DOE's role as an expediter of technology for use by the private sector. DOE will not be the user or purchaser of the commercial products resulting from this program. Its selection and procurement procedures should better reflect this distinction. Second, the information requirements of the PON should be substantially reduced. The requirement for full-scale environmental analysis should be dropped in favor of a site-specific analysis of environmental impacts. More latitude should be given to proposers in estimating potential for commercial use. The fact that a project is proposed shows that interest exists not only by the utility but its cosponsors who are typically the ultimate vendors.

Third, the selection criteria should reflect the importance to Congress of demonstrating technologies that can be applied on a retrofit basis to the existing generating capacity in the U.S. The criteria should emphasize retrofittability, cost-effectiveness ($/ton removed), and emission reduction potential. Also, the basis for DOE's use of a 65/35 ratio of private to federal funding (as opposed to the 50/50 minimum required by Congress) is unclear. If rigorously applied, this will also discourage a number of valuable demonstration opportunities.

Fourth, the electric utilities should not be required to "repay the loan." This requirement not only discourages participation but causes confusion since utility profits are established by regulatory bodies. It is important that the second solicitation encourage stronger utility industry participation since our industry is by far the nation's largest user of coal and is fundamental to the nation's economy. Our industry is also the one through which the greatest environmental and productivity benefits can be realized by application of clean coal technologies.

Fourteen projects were placed in a back-up status by DOE after the initial selection in July and provide a good starting point for awards in this next phase. Several projects which should be given strong consideration include:

1. Wisconsin Electric Power (WEPCO)-Turbocharged Pressurized Fluidized Combustion (PFBC) Retrofit

   The PFBC demonstrations proposed to the DOE by Wisconsin Electric Power Company and American Electric Power Company (AGP) are highly complementary and EPRI has long encouraged the implementation of both projects. Although there are similarities between the two projects, it must be emphasized that they each provide unique design, performance, maintenance and cost information for two different types of PFBC's. If both projects were funded, their complimentary nature would provide a broader basis for comparison and evaluation of PFBC by the electric utility industry than either project alone could provide. In the case of AFBC, for example, such complementary has been essential to both the prompt resolution of technology problems and confident utility application.

The most important difference is the thermodynamic cycle. We believe the WEPCO PFBC turbocharged boiler cycle is particularly well-suited for broad, near-term commercial application to repower existing coal and oil-fired plants. The lower technical risk is related to the lower combustion gas temperature leaving the boiler and entering the turbine (740°F vs. 1525°F). The lower gas temperature allows the use of a highly efficient, near-commercial gas filter before the gas turbine to prevent turbine erosion and fouling. At temperatures below 900°F, turbine corrosion is not expected to be a problem because the corrosive alkali gases will have condensed onto particulates in the gas stream. The probability of success in the entire hot gas circuit, including the gas pipes, gas cleaning system and the gas turbine is increased by operating at the lower temperatures of the PFBC turbocharged boiler. In addition to the fundamental difference in the thermodynamic cycle, other areas of complementarity between the projects include boiler design and configuration, hot gas cleanup and turbine/compressor design.

2. Combustion of Medium and Deep Cleaned Coals

Although coal cleaning can potentially provide a fuel with lower sulfur and ash content, its ultimate combustion characteristics must be well defined to determine how broadly the cleaned product can be used. Combustion Engineering has proposed combined coal cleaning and combustion testing on a variety of coals which would provide the electric utility industry with the necessary confidence to select the proper coal and cleaning level compatible with their boilers. Results from such analysis would be used to develop a coal quality impact model from bench, pilot, and full-scale test results. The model could then be used by utilities to better select coals and cleaning processes for their plants.

3. Lime Spray Dryer/Baghouse Flue Gas Clean-Up

TVA's proposed project would demonstrate the capability of the spray dry process to effectively and economically treat flue gas from the combustion of eastern medium to high sulfur coal. Spray drying has been commercially applied to low sulfur coals in the Western U.S. because of cost advantages and the production of a dry product. Application to high sulfur coal has the potential for high SO_2 removal at less cost than conventional wet scrubbing.

4. Western Low Rank Coal Upgrading

The proposal from Western Energy is one of the several processes DOE should consider to upgrade the quality of western low rank coal. Projects involving the Western Energy, Anaconda or Mobil Oil processes will improve the marketability of low rank western coals by reducing the moisture and sulfur content of these coals as well as enhance their heating value for use in existing boilers.

5. Microbubble Flotation Coal Cleaning

Physical coal cleaning technologies commercially available today typically remove 20 to 30% of the total sulfur in coal with reasonable (85% to 90%) heating value recovery for relatively easy-to-clean coals. In order to apply coal cleaning to more difficult-to-clean coal, demonstration of advanced processes focusing on the fine coal fraction (less than 0.6mm) is required to improve sulfur removal efficiency. Studies by EPRI and others, show that clean coals in combination with low capital cost, moderate SO_2 removal technologies (e.g., dry SO_2 control), are cost-effective alternatives in complying with potential acid rain legislation. The microbubble technology such as proposed by United Coal and McDonnell Douglas Energy Systems can represent an important advance in economical cleaning of the fine coal fraction.

In addition to the projects on DOE's backup list, other retrofit applications are also necessary to meet the potential demands on clean coal use by the electric utility industry. Additional technology areas which should be encouraged include: dry SO_2 control; advanced wet scrubbing; and NO_x control

(1) Dry SO_2 Control

Some of the most promising retrofit technologies for moderate-to-low capital cost SO_2 control are dry processes employing injection of alkaline sorbents into the upper furnace cavity, at the economizer inlet, or in downstream ductwork. Such engineered modifications offer substantial emission reduction while minimizing the cost and difficulty of retrofit. The result is a much more cost-effective emission control capability. Several promising technologies are under laboratory and pilot-scale testing by EPA, DOE, EPRI, and other organizations in the U.S. and abroad. The selection by DOE of the B&W/Ohio Edison LIMB project is only one example of this type of technology. In subsequent procurements, DOE should encourage demonstrations of additional dry SO_2 control options using existing electrostatic precipitators (ESPs) for particulate control. Such projects include convective pass injection, in-duct injection, and in-duct spray drying. Hybrid systems, now being tested at pilot scale, offer advantages of heat recovery, separate fly ash collection, and greater sorbent utilization. A variety of such engineered modifications should be encouraged to span the range of plant designs, control methods and operating conditions necessary.

(2) Advanced Wet Scrubbing

The TVA spray dry project has been mentioned as one project that fits this general category. Other advanced systems such as the Chiyoda 121 and the SOXAL process should also be encouraged. Both options provide less costly and more easily retrofittable approaches to high efficiency flue gas scrubbing. The Chiyoda limestone scrubbing process, for example, provides improved reliability and a high quality gypsum byproduct in a compact system design. SOXAL combines sodium scrubbing (no scrubber plugging) with a cost-effective regeneration system to produce salable byproducts (sulfur or sulfuric acid). It can also be retrofitted to poorly performing lime or limestone scrubbers to improve system reliability and performance.

Another related need is FGD upgrades. Considerable SO_2 removal can be realized by improving the performance of existing FGD systems. Studies by EPRI show that with capital already invested, additional sulfur removal from low performing units (50%-75% SO_2 removal) can be achieved by upgrading. This could significantly contribute to reducing SO_2 emissions. An upgrade demonstration project would provide needed guidance to utilities to enhance the flexibility of this option.

(3) NO_x Control

NO_x is becoming increasingly important in the acid rain debate. Analyses by EEI, EPA, and EPRI have shown that compliance costs for NO_x control of proposed legislative initiatives could be as high or higher than SO_2 control costs. These high costs are due primarily to application of post combustion NO_x systems (selective catalytic reduction or SCR) to coal-fired units. SCR technology imposes not only high capital costs (up to $75/kW) but also high operating costs (10 mills/kWh) due to frequent 1-2 year catalyst replacement and the necessity for ammonia as a reductant.

A much more cost-effective approach is low NO_x burner technology which can be applied at $5 to $15/kW. These technologies, however, require full-scale demonstration to prove pilot scale results. EPRI is currently planning a demonstration program for all major boiler types in conjunction with the boiler manufacturers and host utilities. Unfortunately, budget constraints have limited the pace and extent of this program. Additional low NO_x demonstrations for wall, tangential, and cyclone-fired units should therefore be encouraged in subsequent solicitations.

Significant pressure may come to bear on U.S. utilities for applications of post-combustion NO_x control (SCR). SCR technology is being required in Germany and has been employed in Japan for some time. These applications, however, are only for medium to low sulfur coals. Most U.S. plants targeted for SO_2 and NO_x controls are high sulfur coal plants. There is no operating experience with SCR on such coals. Issues of NO_x removal and byproduct formation need resolution before such technology can be considered. Thus, a prototype demonstration of SCR on high sulfur coal should be encouraged in DOE's next solicitation to resolve these uncertainties.

Summary and Conclusions

1. The highly successful Cool Water integrated gasification combined cycle and three atmospheric fluidized bed demonstration projects being led by the utility industry and EPRI provide effective models for the technology demonstration efforts necessary to accelerate clean coal technology. Additional demonstration efforts for other repowering options, such as pressurized fluidized bed combustion, plus the array of cost effective, retrofittable emission control options should be initiated through joint industry/government sponsorship. Unfortunately, the issues surrounding the recent DOE Program Opportunity Notice served to limit the response to this goal.

2. EPRI concludes the following with respect to the DOE Clean Coal Technology Program as implemented to date:

    - The projects awarded in July 1986 will not be sufficient to meet the objectives of the Congressional Clean coal Technology Initiative as defined in P.L. 99-190.

    - The procurement conditions and information requirements of the DOE Program Opportunity Notice (PON) discouraged many important clean coal demonstration proposals. As a result, the PON predestined a project selection which does not represent a balanced and logical program to enhance clean coal utilization.

    - Of particular concern is the very limited opportunity, among the awards made, to demonstrate promising, lower cost, clean coal technologies for retrofitting and repowering existing coal-fired power plants.

    - Several projects identified by DOE in their published back-up list of 14 projects proposed under the PON merit support to partially fill the gap left by the initial selection. These include:

  - Turbocharged PFBC retrofit (WEPCO)
  - Combustion AFBC retrofit (C-E)
  - Lime spray dryer retrofit (TVA)
  - Clean and upgrade low rank coal (Western Energy)
  - Microbubble flotation for coal cleaning (United Coal)
  - Indirect coal liquefaction with IGCC (TVA)
  - Circulating AFBC retrofit (Colorado-Ute)

- A "short form" solicitation should be initiated which targets the additional, retrofittable control technology demonstrations discouraged under the original PON. Technologies which should be emphasized include:

  - Dry sorbent SO_2 control
  - Combustion and post-combustion NO_x control
  - Advanced wet scrubbing
  - Improved physical, chemical and biological coal cleaning

- Government participation in these additional demonstrations, as a risk-sharing partner with the private sector, would be the most effective use of the remaining $350 million. The 50/50 cost-sharing needs of the recommended technologies is also consistent with these available funds.

- The quality of project selection, in terms of meeting the objectives of the Congressional Clean Coal Initiative would be enhanced by an advisory structure empowered to assist DOE with business and technical guidance.

3. The inflexibility of proposed legislation intended to further reduce emissions tends to discourage the application of innovative clean coal technology and limit freedom of choice. The result may be to substantially increase the cost of compliance and delay implementation of new clean coal generating capacity which combines emission control and cost reduction. The result will be eroding environmental quality and economic productivity, quite contrary to the expectations of the legislation.

4. The future for clean coal technology is now. Success depends on prompt, aggressive action by government and industry. The Clean Coal Technology program supporting private sector demonstration initiatives can substantially enhance the nation's ability to commercialize the many developments in clean coal technology if implemented as intended by Congress. EPRI is prepared to continue to do its part in supporting these efforts.

Table 1

PROJECT SUBMISSIONS RECEIVED BY DOE CATEGORIZED BY TECHNOLOGY

Technology	Number of Submissions Feb. 1985	Number of Submissions Apr. 1986	Selected July 1986
Flue Gas Cleanup	31	5	2
Fluidized Bed Combustion	27	8	1
Surface Coal Gasification	27	6	2
Coal Preparation	22	10	-
Heat Engines	13	-	-
Advanced Combustors	10	1	1
Alternative Fuels	8	1	-
Fuel Cells	8	3	-
Coal Liquefaction	5	2	1
Underground Coal Gasification	4	1	1
Gas Stream Cleanup	2	-	-
Magnetohydrodynamics	2	-	-
Non-Technology Specific	16	1	-
Iron and Steel Processes	-	4	1
Not Defined or Confidential	-	8	-
Compressed Air Energy Storage	-	1	-
Total	175	51	9

Mr. BOUCHER [presiding]. Thank you very much, Mr. Yeager.

Dr. Harrison, we will be happy to hear from you.

And the Chair would ask the witnesses to please try to keep their statements to about 5 minutes—about 10 minutes.

STATEMENT OF DR. WILLIAM B. HARRISON, SENIOR VICE PRESIDENT, SOUTHERN COMPANY SERVICES, REPRESENTING EEI

Dr. HARRISON. Thank you. I'm William B. Harrison, senior vice president of Southern Company Services, and I'm testifying today on behalf of the Edison Electric Institute. I wish to thank you for the opportunity of providing this testimony and to commend you for holding these timely hearings.

The final congressional action in appropriating funds and directing the Department of Energy to solicit clean coal projects has been a very important and very welcome signal to the electric utility industry about the priority which Congress places on the development of technologies for using coal cleanly and efficiently. I'm submitting a detailed statement for the record, and I will therefore attempt just to summarize it quickly here today.

Mr. BOUCHER. Without objection, your statement will be included in the record.

Dr. HARRISON. Thank you. I find very substantial agreement with the statements of the other panelists, and I'll try to avoid repetition as I proceed.

Clean coal technologies under development for many years promise to fulfill the need for electricity in the next decade and beyond better than today's pulverized coal units with wet scrubbers. Unlike currently available technologies, new clean coal technologies are projected to be able to meet the demands for adequate emission controls with less sacrifice of productivity, and some promise improved efficiency in the conversion of heat to electricity. Some can be rapidly constructed in increments or modules over a wide range of unit sizes and with the capability of using a wide selection of coal types, thus better matching capacity to actual demand. By simply shortening the time from the decision to build a plant to commercial operation, there is a greater possibility of matching supply to demand, and thus ultimately reducing consumer cost. Greater fuel flexibility may also reduce the cost of coal by creating greater competition. All these benefits to be derived from clean coal technologies address the problems now faced by the electric utility industry in planning for possible capacity additions in the 1990's and beyond.

With respect to the projects which DOE recently selected, it should be noted that, and it's been noted already, that precombustion technology demonstration for example, advanced physical or chemical coal cleaning, and post-combustion technology demonstrations, for example, advanced scrubber technologies were not selected. In the area of technologies applicable to existing plants generally there does not appear to be the hoped for response from the private sector.

In view of the current status of the program, the Edison Electric Institute endorses the action taken in both the House of Representatives and the Senate Appropriations Committee directing the Department of Energy to solicit additional statements of interest from industry for technologies to retrofit, repower, or modernize existing facilities. Furthermore, EEI encourages the Congress and the executive branch to examine current laws and regulations and, if necessary, consider legislation or other reforms to facilitate the widespread commercialization of those clean coal technologies which are successfully demonstrated. If industry demonstrates continuing interest and commitment to further project demonstrations, then a substantive basis will have been provided for further appropriations out of the Clean Coal Technology Reserve. Also, the 14 additional projects that DOE has selected as a second tier of choices from the current solicitation provide substantial justification for added funding.

The utility industry supported the $750 million cost-sharing program originally adopted by Congress and signed into law. We continue to believe that the clean coal effort deserves a public commitment of this magnitude, and we recommend that the Congress consider the need for added funding as additional worthy projects are identified. For industry to respond to a second solicitation for statements of interest, it is exceedingly important that those burdensome provisions included in the first solicitation are eliminated or clarified. And Mr. Yeager I think has addressed that very effectively.

EEI also recommends that Congress and this committee continue to take the lead in assuring that technologies, once demonstrated, are successfully transferred to the marketplace. We should begin now to address other barriers to widespread utilization of these clean coal technologies. For example, if clean coal technologies are to be developed, demonstrated and used, existing environmental regulations may need to be addressed. Many existing regulations are so rigid or are applied so inflexibly as to discourage innovation. It may also be advisable to provide financial incentives in the form of provisions like allowance for construction work in progress for clean coal projects. My written testimony addresses some of these and gives other examples.

The utility industry and others are currently examining what incentives, changes in regulations or legislative proposals might best assist in assuring the widespread commercialization of successfully demonstrated clean coal technologies. We would welcome the opportunity to work with the Congress in fashioning this very essential element of an effective program.

Finally, I would like to comment on acid rain control legislation.

Mr. BOUCHER. We have a call of the House now with 10 minutes remaining to vote, so I think it might be appropriate at this point for the subcommittee to recess. And when we return in about 15 minutes, we will conclude with your testimony and then have questions for the panel.

Dr. HARRISON. Thank you very much.

Mr. BOUCHER. The subcommittee stands in recess for approximately 15 minutes.

[Recess.]

Mr. BOUCHER. The subcommittee will come to order.

Dr. Harrison, I'm advised that you have 4 minutes remaining and——

Dr. HARRISON. Pardon me?

Mr. BOUCHER. I'm advised that you have 4 minutes remaining——

Dr. HARRISON. Thank you.

Mr. BOUCHER [continuing]. Of your allotted testimony, and we will be happy to hear from you.

Dr. HARRISON. Thank you. I appreciate the opportunity to continue, and I don't believe I'll use the full 4 minutes. I was to the final point of my oral statement.

I would like to comment upon the acid rain control legislation which is being considered by the Congress and which mandates major near-term reductions in NO_x and SO_2 emissions. We believe that passage of such legislation will seriously stifle the clean coal technology development. The capital requirements of compliance with proposed acid rain control legislation would be overwhelming to our industry, and inevitably any other funds, that is, any funds otherwise available for new technological development, would be siphoned off to ensure compliance with the legislation. Many existing plants would have to be closed on the basis of economic considerations, possibly bringing the reliability of today's electric supply into question and surely raising a serious concern over our industry's ability to finance and construct new facilities in time to meet tomorrow's needs.

Immediate reductions inevitably would require the use of current scrubber technologies. Once we commit to scrubbers it will not make economic sense to later convert to a new clean coal technology in the same facilities. Additionally, from an energy perspective, the ratepayer will be committing to less than optimum generating systems for the life of the legislation. Clean coal technologies will not be available for widespread utilization before proposed major emission reductions are required under proposed acid rain control legislation. The demonstration of new technologies takes time, and even if we successfully demonstrate some of these technologies by the early 1990's, we will be unable to commit, plan and incorporate these technologies into our generating systems much before the turn of the century. And I believe other panelists have emphasized that point this morning as well.

In summary, Mr. Chairman, we cannot proceed in both directions at once. If massive emission reductions are mandated for the early 1990s, clean coal technologies cannot be developed as planned or as needed.

I thank the subcommittee and its members for your support of clean coal technologies development. And if the Federal Government will share in the risk of development as a partner to industry, I believe we can demonstrate and deploy these new technologies which will benefit the environmental, the ratepayers, and the use of our domestic energy resource—coal. Thank you very much.

[The prepared statement of Dr. Harrison follows:]

HEARINGS BEFORE THE
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
DR. WILLIAM B. HARRISON
SENIOR VICE PRESIDENT OF SOUTHERN COMPANY SERVICES
ON BEHALF OF
THE EDISON ELECTRIC INSTITUTE
SEPTEMBER 10, 1986

I. INTRODUCTION:

I am William B. Harrison, Senior Vice President of Southern Company Services, testifying on behalf of the Edison Electric Institute (EEI). Southern Company Services provides engineering and other specialized services to Alabama Power Company, Georgia Power Company, Mississippi Power Company, and Gulf Power Company, all of which are subsidiaries of The Southern Company. In 1985, nearly 44 million tons of coal were burned at generating stations of the Southern electric system -- making Southern one of the three largest coal users in the United States. We are vitally interested in clean coal technologies. The Edison Electric Institute is the association of the electric utilities. Its members serve electricity to 96 percent of all customers served by the investor-owned segment of the industry. They generate approximately seventy-five percent of all the electricity generated in the country and service 73 percent of all ultimate customers in the Nation.

The electric utility industry strongly endorsed -- and worked for -- the enactment of the $750 million Clean Coal Technology Reserve in 1984. Our industry hailed the action of the Congress last year in appropriating nearly $400 million out of that Reserve to initiate the clean coal technology demonstration program. We appreciate the fact that these funds were provided at a time when the Congress and the Administration were locked in a crucial debate over an ever worsening federal deficit. The final Congressional action in appropriating funds and directing the Department of Energy to solicit clean coal projects has been an important, and welcomed, signal to the utility industry, and others, about the priority which the Congress places upon the development of technologies to use coal cleanly and efficiently.

These written comments will focus upon the following three principal areas related to the federal clean coal technology demonstration program:

First, the importance of the clean coal program to expanding the use of our Nation's most abundant fossil fuel -- coal -- and to meeting the utility industry's needs for new capacity that is provided in an environmentally acceptable manner;

second, the Congressional guidelines to the Department of Energy for implementing the program and the conformance of project selections to that guidance; our recommendations for further clean coal demonstrations; and, our suggestions to the Congress and the Executive Branch to undertake activities to encourage widespread utilization of successfully demonstrated technologies; and,

third, the concern of the electric utility industry that passage of legislation now under discussion to further control powerplant emissions may hinder, or even preclude, the development of many promising clean coal technologies.

II. IMPORTANCE OF DEVELOPING EMERGING CLEAN COAL TECHNOLOGIES:

A. Utility Involvement in Developing Technology Options To Better Ensure the Increased Use of Coal

The EEI shares the view of the Congress that emerging technologies are essential to the increased use of coal in an environmentally acceptable manner. We also believe that cost-effective coal utilization and environmental protection can -- and should -- be mutually compatible. One goal need not be achieved at the expense of the other and clean coal technologies are the key to assuring this compatibility.

To this end, our industry, and industry supported organizations such as the Electric Power Research Institute (EPRI), remain committed to the development of the most cost-effective means of SO2 and NOx control. EPRI, as well as many individual utilities, has expended many years and millions of dollars in the conduct of major technology development programs. It should be noted that expenditures of productive dollars to broaden the range of available technologies pre-date much of the legislation enacted to protect the environment.

The Southern Company, as a major contributor to EPRI, has participated in the development of practically all of the technologies contemplated for support through the Clean Coal Technology Reserve. Within The Southern Company, we have gained substantial expertise with five different types of flue gas desulfurization technologies; we are directly involved with the atmospheric fluidized bed demonstration project managed by the Tennessee Valley Authority; we manage the high-sulfur coal baghouse test facility for EPRI; and, since its inception in 1972, we have managed the Advanced Coal Liquefaction Research and Development Facility for process development of Solvent Refined Coal and Integrated Two-Stage Liquefaction of Coal.

Many other utilities have taken an equally active role in the development of new technologies. Furthermore, over one-third of EPRI's planned budget during the next five years will be directed to clean coal science and technology. This is in addition to the $500 million which EPRI already has invested in the research and development of clean coal technologies.

The federal government's new clean coal technology demonstration program complements these ongoing industry efforts. If sufficiently funded and properly implemented in accordance with Congressional intent, the clean coal program should result in the rapid demonstration of technologies which can thereafter be made available for widespread commercialization. An accelerated program should assure the commercial availability of these technologies by the turn of the century or sooner. Federal involvement and financial support are essential to this joint endeavor.

B. Increased Capacity Requirements To Be Fueled by Domestic Coal Require These New Technology Options

Powerplants now installed or ensured of construction will support an average growth rate in electricity demand of about one percent a year through the mid-1990's. While projections about the rate of growth of electricity vary greatly and are the source of considerable debate and uncertainty, most long-range forecasts for electricity consumption growth fall in a range of 2.0 to 4.0 percent per year. The electric utility industry is projecting growth in consumption of 2.7 percent and growth in peak demand of 2.5 percent over the next decade.

According to the EEI even this modest growth rate means that by the year 2000, "America is likely to need at least 100 million to 200 million kilowatts of generating capacity in addition to the powerplants now in place and under construction." [Report of the Edison Electric Institute on Nuclear Power, February 1985, p.1] The DOE has confirmed that there is "potential for inadequate power supply in some regions" during the 1991-1993 period even assuming all planned capacity is brought on-line as scheduled. [DOE publication:DOE/IE0003, Staff Report: Power Supply and Demand for the Contiguous United States 1904-1993]

Without question, uncertainties surround all of the factors affecting the need for new capacity. In addition to the rate of economic growth, the retirement of older units, the more efficient use of current capacity, and programs designed to achieve both conservation and load management will also affect capacity requirements. Nonetheless, projecting a plausible range of very modest growth rates and projecting a minimum level of replacement of aging and high-cost facilities, some new capacity beyond what is already planned will still be required in the early to mid 1990's.

Much of any new capacity either planned or projected will use coal. Some fifty-five percent of the electricity produced in the United States today is generated in coal fired utility powerplants. Existing plants, with a combined generating capacity of 265,000 megawatts, consumed 688 million tons of coal in 1985 according to preliminary data from the North American Electric Reliability Council. That data also estimates that figure may grow to 797 million tons of coal by 1995.

While projections of capacity shortfalls persist, electric utilities have virtually ceased ordering new electric generating capacity of any kind. Existing construction programs are being completed and utilities are moving into a period in which little capacity is under development. This circumstance can be attributed to the fact that current and planned generating capacity will be sufficient for a few years and that utilities face strong economic and financial disincentives to undertaking new construction. Such disincentives include the possibility of penalties, such as not being allowed to earn a return on the entire investment, if demand growth proves to be less than expected. The jeopardy also exists where demand is greater than expected and capacity is not available. Reliance on current options affords little comfort. As many as ten years are needed to plan and construct a conventional baseload coal-fired generating facility. If that planning is not taking place now, then new conventional capacity may not be available in the mid-1990's when shortfalls might occur.

Current generation technologies can meet the need for any new capacity and are capable of compliance with increasingly more stringent siting and environmental requirements. However, the costs to consumers would be high. According to the EPRI it costs three times more today in constant dollars to install a kilowatt of conventional coal-fired generating capacity than in 1967. More than 30 percent of the physical cost of a plant is for environmental control. Further, conventional coal-fired powerplants are characterized by economies of scale, meaning they must be relatively large units and, if sized for maximum cost-effectiveness, they may be too large and too expensive for the demand increments of many utility systems. Also, current flue gas desulfurization systems address one environmental problem but create wet scrubber sludge -- a by-product which can cause difficult disposal problems. New clean coal technologies may avoid or reduce such problems, and, in some instances, by-products may be marketable. Successful development of these emerging technologies will provide utilities with a number of additional supply options with which to meet growing demand during this period of considerable regulatory and demand uncertainty and economic and financial disincentives.

Given the margin of capacity currently available, the electric utility industry has a unique window of opportunity through which a transition to new technologies can be achieved with minimum risk. The time is now. We are quite literally at the threshold of fundamental change in the technological base for power generation in this country.

Clean coal technologies promise to fulfill the need for electricity in the 1990's and beyond better than today's pulverized coal units with their wet scrubbers. Unlike these currently available coal-fired generating units with their flue gas desulfurization systems, new clean coal technologies are projected to be able to meet the demands for adequate emission controls with greater productivity. Further, some promise improved efficiency in the conversion of Btu's to electricity. Also, many can be rapidly constructed in increments or modules over a wide range of unit sizes, thus better matching capacity to actual demand. By simply shortening the time from the decision to build a plant to commercial operation, there is a greater possibility of matching supply to demand and thus ultimately reducing consumer costs. Greater fuel flexibility may also reduce the costs of coal by creating greater competition.

All of these benefits that may be derived from successfully demonstrated clean coal technologies tend to address the very problems now faced by the utility industry in planning for the capacity requirements of the 1990's and beyond. For these and other reasons the development of clean coal technologies is important to the future of the electric utility industry.

III. CONGRESSIONAL GUIDANCE IN PROJECT SELECTION AND RECOMMENDATIONS FOR FUTURE ACTION

A. DOE Adherence to Congressional Guidelines in the Selection of Clean Coal Projects

In July the DOE, pursuant to a schedule mandated by Congress, selected nine clean coal technology demonstration proposals from 51 submitted in response to a Program Opportunity Notice issued in February, 1986. The Department has recently submitted to the Congress a description and analysis of each proposal submitted. EEI has not had an opportunity to review that information. Also, the public abstracts which briefly describe the projects contain abbreviated descriptions. Therefore, we are unable to attempt an analysis of each selected project. Rather, some general comments are made in this testimony about the type of projects which DOE selected and the conformance of those selections to the general guidelines that the Congress adopted for implementation of the program. These comments do not represent a judgment as to whether specific project selections will achieve the full technology demonstration required so that the utility industry, at the conclusion of the demonstration, will have sufficient data to proceed with commercial scale projects.

The Congress provided that all clean coal technologies, for all energy market applications, using the full coal resource base would be eligible for financial assistance. Given the broad scope of the program and the attempt by the Congress to make as many technologies as possible eligible for the program, it would appear that the DOE succeeded in meeting these general requirements with the projects selected.

However, not all clean coal technology areas are represented in the final selections. No pre-combustion technology demonstrations (for example, advanced physical or chemical coal cleaning) and no post-combustion technology demonstrations (for example, advanced scrubber technology) were selected. Further, in the area of retrofit technologies, there does not appear to have been the hoped-for response from the private sector. This is especially true with respect to low cost engineered modifications to existing utility facilities for reducing SO2 and NOx. The following table shows the selected projects along with the total number of responses by technology categories to the Program Opportunity Notice (PON) of February 17, 1986, compared with the responses to the February, 1985, request for statements of interest and informational proposals:

PROJECT SUBMISSIONS RECEIVED AND SELECTED BY DOE, CATEGORIZED BY TECHNOLOGY

Technology	Number of Submissions Feb. 1985	Number of Submissions April 1986	Selections July 1986
Flue Gas Cleanup	31	5	2
Fluidized Bed Combustion	27	8	1
Surface Coal Gasification	27	6	2
Coal Preparation	22	10	-
Heat Engines	13	-	-
Advanced Combustors	10	1	1
Alternative Fuels	8	1	-
Fuels Cells	8	3	-
Coal Liquefaction	5	2	1
Underground Coal Gasification	4	1	1
Gas Stream Cleanup	2	-	-
Magnetohydrodynamics	2	-	-
Non-Technology Specific	16	1	-
Iron and Steel Processes	-	4	1
Not Defined or Confidential	-	8	-
Compressed Air Energy Storage	-	-	-
Total	175	51	9

A number of electric utilities and other corporations may not have submitted proposals because of the paperwork requirements and confusion about repayment which accompanied the Draft Program Opportunity Notice, issued by DOE in January, 1986. For example, Section VI-4 of that Draft PON set forth a requirement for recovery of federal funds contributed to the project. The language provided: "The Government intends to recover up to its contribution from the proposer out of revenues during the period of performance, out of net revenues received if the project is operated by the proposer beyond the period of performance...." These provisions appear to have had a very negative effect on companies considering proposals. Changes issued in the final PON and the ongoing discussions concerning repayment did not overcome this problem.

The confusion over the repayment provision may have been especially relevant to retrofit technologies which might limit the cost increase of emission controls but will not generate additional revenue from the retrofitted facility. In other words, no additional revenues for repayment would be available.

While the Congress recognized that private industry runs a substantial financial risk in the demonstration of new and innovative technologies, it was not evident that DOE's repayment provisions adequately focused upon the realities which confront a regulated electric utility. If an untried technology does not prove out, individual utilities and their shareholders could be required by state regulatory utility commissions to shoulder the cost for the failed effort. Ultimately, this would adversely affect investment in the utility industry, resulting in possible lower electric generating capacity and higher rates for the consuming public. Even if the technology proves to be successful, the amount and timing of any return on what is a very substantial investment will be uncertain, depending upon whether, when and to what extent public utility commissions treat these expenditures in establishing rate bases.

Clearly, the utility's ratepayer will benefit if the demonstration project is successful. However, so will other ratepayers (who are also taxpayers) in other utility systems that ultimately deploy these demonstrated techniques. We believe, therefore, that the government's portion of the project should be viewed as that portion of risk-sharing which the government bears on behalf of all ratepayers and taxpayers.

In addition to the repayment provisions, draft and final PON requirements for market analysis impacts and environmental information may have been overwhelming to many companies. The detailed information required by the DOE about the environmental, health, safety and socio-economic aspects of each technology was, in the judgment of our industry, premature and unreasonable at this stage of technology development. Such information added unnecessarily and substantially to the cost of proposal preparation.

B. Recommendations for Further Action

The utility industry supported the $750 million cost-sharing program originally adopted by Congress and signed into law. We continue to believe that the clean coal technology demonstration effort deserves a public commitment of this dollar magnitude. Others have adopted a similar position, including the DOE's Energy Research Advisory Board which recommended a total $1.9 billion government and industry cost-shared program. The $400 million appropriations already provided is an important first step.

The Edison Electric Institute supports the action taken by the House of Representatives and the Senate Appropriations Committee directing the Department of Energy to solicit additional statements of interest from industry for technologies to retrofit, repower or modernize existing facilities. Furthermore, we encourage the Congress and the Executive Branch to examine current laws and regulations and, if necessary, consider legislation or other reforms to facilitate the widespread commercialization of successfully demonstrated clean coal technologies.

For industry to respond to a second solicitation for statements of interest, it is exceedingly important that those burdensome provisions included in the first solicitation are eliminated or clarified. The Senate Appropriations Committee report, to accompany the fiscal year 1987 Interior and Related Agencies Appropriations bill, seeks to make those clarifications and assurances to potential project sponsors. The requirements of the solicitation should be simple and positive in tone. A skeptical potential project sponsor need not read in the Federal Register, as was the case in the original solicitation, that no funds are provided and none are requested nor anticipated.

If industry demonstrates continuing interest and commitment to further project demonstrations, then a substantive basis will have been provided for further appropriations out of the Clean Coal Technology Reserve. Also, the fourteen additional projects that DOE has already selected as a second tier of choices from the current solicitation provide substantial justification for added funding. Further, once additional information is made public about those projects already selected, the Congress and industry will be in a better position to determine the scope and direction of a second phase to the clean coal technology demonstration program.

EEI also recommends that the Congress and this Committee continue to take the lead in assuring that technologies, once demonstrated, are successfully transferred to the marketplace. We should begin now to address other barriers to the widespread utilization of clean coal technologies.

Too often, technologies are demonstrated and then shelved. Importantly, the current clean coal program relies upon industry as a cost-sharing partner to take the lead in bringing these technologies to the marketplace. The ideal role of government is as a silent partner where government need not play an active role in the management and development of specific projects. By adhering to this type of involvement, the private sector, as the ultimate user of the technologies, will determine the most cost-effective and commercially viable options. Government can, however, address and remove barriers which are likely to impede the use of these technologies.

For example, if clean coal technologies are to be developed, demonstrated and used, existing environmental regulations may need to be addressed. Many existing regulations are so rigid or are applied so inflexibly as to discourage innovation. Current New Source Performance Standards (NSPS) require a fixed level of control technology performance. In many cases, these standards preclude use of technologies that may remove marginally lower amounts of pollutants, but produce substantial economic and energy savings. EPA has the legal authority to adopt more flexible NSPS -- by writing different standards for different types of boilers, by modifying the Commercial Demonstration Permit regulations to allow additional technologies to apply for these permits, or by granting waivers to allow implementation of clean coal technology where appropriate -- and should signal its willingness to do so.

In addition, EPA has found in the context of the 1979 NSPS for utilities that it is important to base utility emission standards on a 30-day averaging time, in light of the variability in fuel characteristics and control equipment performance. EPA, however, has been reluctant to clarify that emissions standards provided for under the 1971 NSPS and state implementation plans also reflect 30-day averaging. Such clarification is crucial if new technologies are to be capable of complying with emissions standards, and therefore will be critical to the success of the clean coal technology demonstration program.

Finally, since the clean coal technology program by definition addresses technologies that have not been demonstrated, sources involved in demonstration projects will likely experience problems with pollution control equipment operation. EPA should make clear that, as long as the public health-based air quality standards, during the demonstration period are met, sources involved in such demonstration projects will be afforded flexibility with respect to compliance with emission standards. Among other things, EPA should move forward with emission trading and expanded "bubbles" to encourage these innovative technologies.

The Congress should also examine the incentives for clean coal technology commercialization which could occur through the tax code and items such as construction work in progress, which could help to commercialize these more-efficient technologies.

The utility industry and others are currently examining what incentives, changes in regulations or legislative proposals might best assist in assuring the widespread commercialization of successfully demonstrated clean coal technologies. We would welcome the opportunity to work with the Congress in fashioning this very essential element of an effective program.

IV: THE BARRIER TO CLEAN COAL TECHNOLOGY DEVELOPMENT POSED BY ACID RAIN CONTROL LEGISLATION

Clean coal technology development and demonstration is supported by the electric utility industry as a means of productively utilizing dollars to achieve superior environmental control in a cost-effective manner. We do not believe that an acid rain control program such as that embodied in S. 2203 or in H.R. 4567 reflects this same policy.

Various utilities, including The Southern Company, have indicated that imposition of an acid rain control program will require the obligation of all available resources to ensure compliance with the law. Little or no resources will be available for clean coal technology development, therefore making it highly unlikely that new technologies could be developed by the early 1990's. If either the House or Senate bill passes in its current form, we would simply and immediately have to forego clean coal technology development. What resources are available would have to be applied to the problems of complying with this new law.

Also, each electric utility will develop a specific plan of compliance patterned to the needs and abilities of that utility. It is believed that few are likely to choose a course of action whereby an individual unit will be controlled twice, once through the switching of fuels, and later, through the retrofitting of a clean coal technology that is not commercially available at this time. Compliance plans are likely to be fashioned so that affected units are controlled once. If a unit is to remain in service after 1997 when H.R. 4567 would require an average 1.2 pounds of sulfur emitted per million Btu of heat input then some utilities, for example, would plan to comply with the 1997 requirement, not the less stringent 1993 requirement of 2.0 pounds per million Btu of heat input.

While some of these technologies may be available for commercial application in the mid to late 1990's it is simply not true that a utility can plan now to use an unproven technology to comply with the provisions of proposed acid rain control legislation. Rather a utility will plan to comply by use of whatever means are commercially available now; few will risk the possibility of non-compliance through reliance upon an unproven technology.

As the Congress continues examination of H.R. 4567 and other associated proposals to impose new emission limitations upon electric powerplants, EEI would urge that the impact upon the clean coal initiative, which was funded less than nine months ago, be carefully considered. There is an opportunity for the accelerated development of several new technology options which will permit us to greatly expand the possible use of our vast coal resources in an environmentally acceptable manner. Demonstration and widespread utilization of these new technologies should not be stymied or prevented by the imposition of a costly and premature regulatory program that will, in all likelihood, dictate reliance upon today's technology -- pulverized coal-fired boilers and current generation scrubbers.

V. CONCLUSION

The Federal clean coal technology program is vitally important toward meeting future capacity needs of electric consumers in a cost efficient and environmentally acceptable manner.

The Edison Electric Institute believes that Federal assistance can greatly accelerate the demonstration of these technologies. EEI supports the action of the House of Representatives in directing the Department of Energy to solicit the private sector for additional statements of interest for clean coal technologies to retrofit, repower or modernize existing facilities. Information gathered in this process may assist the Congress in determining the need for additional appropriations.

We also encourage the Congress to begin an examination of laws and regulations which will impact upon the widespread commercial use of these technologies. A financial and regulatory environment must be created or maintained that will be conducive to utilization of new technologies. Should changes in laws or regulations be required, EEI urges the Congress to address those matters as soon as possible. Our industry is prepared to assist in this endeavor and to do all possible to ensure the success of the clean coal program.

Mr. **Boucher**. Thank you very much, Dr. Harrison.

PANEL 1 DISCUSSION

And I extend the subcommittee's thanks to the other panel members as well for their very thoughtfully prepared and presented testimony.

I have several questions, and I would simply ask this of whoever would care to answer. Any of you may volunteer to do that. I would be happy to hear from each of you if you would like to comment.

First, I wonder what you think would be a responsible time frame for the negotiations that are presently ongoing between DOE and the awardees for the first round to be concluded?

Mr. Yamagata?

Mr. **Yamagata**. Mr. Chairman, I think the point that Mr. Bauer made this morning was appropriate, and that is that the negotiating process needs to be completed as quickly as possible. I would note in complimenting the Department that they have done an extraordinary job to date in implementing this program. Recall, if you will, that the program was signed into law with appropriations in December of 1986 and the Department is in the process of negotiating for the commitment of upwards of $360 million by July of this year. That's a better track record than what I have seen on other types of, but similar, programs. If they can maintain that process, then, we would hope that they could resolve these cooperative agreements certainly by the end of the year.

Mr. **Boucher**. Anyone like to add to that?

Mr. Yeager.

Mr. **Yeager**. I would just add to it by endorsing the comments made by Mr. Fuqua earlier this morning in which he expressed some concern about the so-called backup list of 14 which are in a standby status. Many of those important projects, if they are going to be implemented, those groups need to have advice on that as quickly as possible or they will lose the ability to have the teams.

Mr. **Boucher**. Well, to follow that up, I would say that for my own part I was quite pleased to hear the statements of a number of you expressing disappointment that no coal preparation projects were awarded in this first round. I happen to think that some of the most promising research that's occurring today is in the coal preparation field. And I think that DOE has overlooked that very essential fact in not making an award to 1 of the 10 applications in the preparation area that, in fact, were submitted.

I know that at least 1, perhaps more than 1, coal preparation application is on this backup list of 14. What advice would you give to the 14 people who are now in that mode, who are waiting to see whether they will have an opportunity to participate? What should they be doing at this point in time to enhance their position?

Mr. **Yeager**. I think from our perspective it would be just hang tough. Hang in there and attempt to keep the group together, and also look at ways of perhaps trying to implement at least some portion of the program.

I would agree that the coal cleaning area is very important. It is fundamental to a lot of the other technologies that were being talked about in here. It is not just a role in its own part, it is a foundation for many of the other technology opportunities.

Mr. BOUCHER. Any other advice for those 14?

Mr. HIGH. Well, let me comment since we are 1 of the 14, I believe. I think it—in fact, we will be evaluating in the next 2 weeks whether we want to answer the letter. The proposals are good through December, and we've been asked to extend those to March next year by the Department of Energy. It's going to be extremely difficult for most of us to keep the people together that would do these projects. And in fact, in our case, where we had already negotiated a contract with General Electric Co., for the scope of supply for the project, all of that negotiation now will have to be redone. And the longer we wait on that, of course, the more costly that will be.

So it's an extremely important issue and I commend DOE for moving as fast as they have—they surprised me, I will say—and I think it would behoove them to get the final negotiations with the nine as early as possible for those reasons.

Mr. BOUCHER. And would you agree that the end of this year is an appropriate time for the conclusion of those negotiations?

Mr. HIGH. I would hate to specify a schedule for DOE. I, respectfully, decline to comment on that.

Mr. BOUCHER. Mr. Yamagata, I think you have some current knowledge of the status of the second solicitation as it would relate to retrofit technologies. I believe the Senate has been considering that as a part of the Interior appropriations bill. Can you comment on where that stands and what you think the future of that will be?

Mr. YAMAGATA. I'd be happy to, Mr. Chairman. Both the House of Representatives in H.R. 5234, which is the fiscal year 1987 Interior and Related Agencies appropriations bill, and the Senate Appropriations Committee have adopted statutory language directing the DOE to conduct a second round of statement of interest solicitation or informational proposals that are directed at repowering, retrofiting or modernizing existing facilities.

In light of the fact that both Houses have similar language, it is our assessment at the moment that the Congress is likely to enact that type of directive and, hopefully, the administration, as Mr. Bauer alluded to earlier today, will embrace that directive and move forward expeditiously.

Mr. BOUCHER. Gentlemen, I am going to conclude my questions of you with that. We have one additional panel to testify, and I have some obligations of a personal nature this afternoon, so I'm going to say that if other members have questions that they would like to propound to you, that will be done in writing and you will receive those. And the record will remain open both for those questions and for your answers.

I want to thank you very much for your attendance here this morning.

The final panel we have today is three witnesses: Mr. Michael Koleda, the president of the Council on Alternative Fuels; Dr. Charles Henderson, the president of the Clean Coal Coalition; and John McCormick from the Environmental Policy Institute.

If those gentlemen are with us today, we would be pleased to hear from you at this time.

Mr. Koleda, we will be pleased to begin with you.

STATEMENTS OF MICHAEL S. KOLEDA, PRESIDENT, COUNCIL ON ALTERNATE FUELS

Mr. KOLEDA. Thank you, Mr. Chairman. My name is Michael Koleda, and I'm president of the Council on Alternate Fuels. The council is an international association that was formed in the wake of the second energy crisis, as it's called, back in 1979. We are companies concerned with energy preparedness in the industrialized nations. Members are committed to the development and application of technologies to convert fossil fuels to environmentally acceptable alternative energy forms and basically to extend the capability of the United States to rely on its substantial solid fossil fuel resources in an environmentally acceptable manner.

I would like to offer my views on progress made to date and future directions of the Clean Coal Technology Program. The testimony will be brief. The message is a simple one: That Congress must continue to take a long-term view of U.S. energy preparedness and the dangers posed by declining domestic oil production and increasing imports. This long-term view must include commitment to full funding and implementation of the clean coal program.

Over the past 6 years a combination of changing world energy market conditions, domestic fiscal problems, administrative ineptness, and political pressures have really decimated our efforts in the United States to demonstrate a range of alternate fuels technologies. We must be sure therefore that this program, the clean coal program, is kept on track and accomplishes its objectives in a timely manner.

Let me just say by way of preface that Congress and the DOE are to be commended for bringing the program along as quickly as it has. Others have made that point today. It's been less than 2 years since Congress created the program and directed DOE to issue its first solicitation. DOE has adhered to the schedules that Congress set out for its first round and is negotiating, of course, with nine. We've seen progress. There is room, however, for improvement, and I'd like to focus on some midcourse corrections that I think would be helpful.

Others have noted it but I'd like to underscore it; the most noticeable shortcoming in the first round is the lack of direct electric utility involvement in the great majority of the projects. Only two of the nine priority projects have a utility as a sponsor, and yet Congress clearly intended that the focus be on the electric utility sector, which accounts for 85 percent of coal use in the United States. In the next round of solicitations we think DOE should devise a strategy to involve utilities more directly in the program.

The next round of funding, as others have said, should be directed toward projects that will provide experience in retrofit applications for existing coal-fired utility boilers. The origins of the program are in problems caused by sulfur emissions and other emissions of existing coalfired plants, and it's important that retrofit be given more attention.

We applaud the language in H.R. 5234, the fiscal 1987 Interior and Related Agencies appropriations bill passed by the House that calls upon DOE to take the first steps in soliciting expressions of interest by industry in clean coal retrofit projects.

While the clean coal program has made satisfactory progress to date, I share in the misgivings that some of you and some of the panels before have expressed about the lack of a schedule for completing negotiations for cooperative agreements. You raised the issue of scheduling just recently. I believe that one reason for the progress we've seen has been the strict timetables and close oversight of the program by Congress. However, there appear to be no deadlines placed upon DOE or project sponsors to come to mutually agreeable contract terms. I can appreciate the fact that Congress is hesitant to interfere in the negotiation timetable process. The program will, however, not be served well, I suspect, by open-ended negotiations. A responsible deadline for the parties to reach agreement would serve notice to all concerned that Congress intends that the program result in the completion of projects, not endless generation of paper.

Finally, I would like to comment briefly on an issue that is beyond the purview of the program but critical to its success—others have touched on it—and that is, acid rain legislation now pending before Congress. Both initiatives, the acid rain legislation and this program, have as a goal reducing atmospheric sulfur emissions and other emissions from coal-fired powerplants. It's a goal to which all subscribe and which can ultimately make coal a more attractive fuel and expand the markets for its use.

Yet, if the two efforts are to work in concert, Congress should be careful in setting the timetables for compliance under acid rain legislation so that they do not foreclose new technology options for utilities to reduce sulfur emissions. If sulfur reduction compliance dates for existing coal-fired plants are set too early, utilities will either use existing scrubber technology or they'll switch to oil or gas, as is happening now, or shut plants down; and none of these options includes incorporating new clean coal technologies. If the clean coal program is to serve a purpose in bringing to commercial use new technologies for utilities' sulfur reduction, time must be allowed to demonstrate those technologies before the deadlines come into effect.

In closing, I would like to ask members of the committee to just step back a moment from the issues of clean coal and acid rain and electricity demand growth to see the larger context in which these are playing out. The larger issue under consideration of course, is energy preparedness for the United States in the coming decade. The Nation, as you know, is again on the path to decreased domestic oil production, increased demand and higher reliance on imported oil. The facts and the figures support this very clearly.

There should be no doubt in our minds that the energy future of the United States has to rely to a larger degree on our domestic solid fossil fuels, principally coal; not just for electricity generation, but also for chemicals and for transportation fuels. But we have yet to overcome the economic, environmental, technical, and political barriers that stand in the way of the full realization of coal's potential. This clean coal program offers the promise of reducing some of these barriers to increase coal use, and for this reason alone Congress must vigorously oversee the management of the clean coal program to assure the American people that this particular opportunity, unlike others, will not be lost.

Thank you very much.

Mr. BOUCHER. Thank you, Mr. Koleda.

[The prepared statement of Mr. Koleda follows:]

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TESTIMONY

OF

MICHAEL S. KOLEDA
PRESIDENT
COUNCIL ON ALTERNATE FUELS

SUBCOMMITTEE ON ENERGY DEVELOPMENT & APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

SEPTEMBER 10, 1986

MR. CHAIRMAN, MY NAME IS MICHAEL S. KOLEDA AND I AM PRESIDENT OF THE COUNCIL ON ALTERNATE FUELS. THE COUNCIL IS AN INTERNATIONAL ASSOCIATION OF COMPANIES CONCERNED WITH ENERGY PREPAREDNESS IN THE INDUSTRIALIZED NATIONS. OUR MEMBERS ARE COMMITTED TO THE DEVELOPMENT AND APPLICATION OF TECHNOLOGIES TO CONVERT FOSSIL FUELS INTO ENVIRONMENTALLY ACCEPTABLE ALTERNATE ENERGY FORMS.

I AM HERE TODAY TO OFFER MY VIEWS ON PROGRESS MADE TO DATE AND FUTURE DIRECTIONS FOR THE DEPARTMENT OF ENERGY'S CLEAN COAL TECHNOLOGY PROGRAM. MY TESTIMONY WILL BE BRIEF, BECAUSE MY BASIC MESSAGE IS SIMPLE -- THE CONGRESS MUST CONTINUE TO TAKE A LONG TERM VIEW OF U.S. ENERGY PREPAREDNESS AND THE DANGERS POSED BY DECLINING DOMESTIC OIL PRODUCTION AND INCREASING IMPORTS. THIS LONG TERM VIEW MUST INCLUDE A COMMITMENT TO FULL FUNDING AND IMPLEMENTATION OF THE CLEAN COAL PROGRAM.

OVER THE PAST SIX YEARS A COMBINATION OF A CHANGING WORLD ENERGY MARKET, DOMESTIC FISCAL PROBLEMS, ADMINISTRATIVE INEPTNESS, AND POLITICAL PRESSURES HAVE DECIMATED OUR EFFORTS AT DEMONSTRATING A RANGE OF ALTERNATE FUELS TECHNOLOGIES. WE MUST MAKE SURE THAT THE CLEAN COAL PROGRAM -- WHICH THIS COMMITTEE HAD A LEADERSHIP ROLE IN INITIATING -- IS KEPT ON TRACK AND ACCOMPLISHES ITS IMPORTANT OBJECTIVES IN A TIMELY MANNER.

I WILL PREFACE THESE COMMENTS BY SAYING THAT BOTH THE CONGRESS AND THE DOE ARE TO BE COMMENDED FOR BRINGING THE PROGRAM TO THIS POINT IN SUCH A SHORT PERIOD OF TIME. IT HAS BEEN LESS THAN TWO YEARS SINCE THE CONGRESS CREATED THE CLEAN COAL TECHNOLOGY RESERVE AND DIRECTED THE DOE TO ISSUE ITS FIRST SOLICITATION FOR EXPRESSIONS OF INDUSTRY INTEREST IN THE CLEAN COAL PROGRAM. THE DOE HAS ADHERED TO CONGRESSIONAL SCHEDULES FOR ITS FIRST ROUND SOLICITATION AND IS NEGOTIATING COOPERATIVE AGREEMENTS WITH NINE PROJECTS.

WE HAVE SEEN PROGRESS. BUT THERE IS ROOM FOR IMPROVEMENT. MY TESTIMONY WILL FOCUS ON PROPOSALS FOR MID-COURSE CORRECTIONS IN THE PROGRAM DURING THE NEXT ROUND OF CLEAN COAL FUNDING.

THE MOST NOTICEABLE SHORTCOMING OF THE FIRST ROUND SOLICITATION WAS THE LACK OF DIRECT ELECTRIC UTILITY INVOLVEMENT IN THE GREAT MAJORITY OF THE PROJECTS. ONLY TWO OF THE NINE PRIORITY PROJECTS HAVE A UTILITY AS A SPONSOR. YET THE CONGRESS CLEARLY INTENDED THAT THE FOCUS BE ON THE ELECTRIC UTILITY MARKET WHICH ACCOUNTS FOR APPROXIMATELY 85% OF COAL USE IN THE U.S. MORE SPECIFICALLY, THE CONGRESS INTENDED THE PROGRAM TO DEAL WITH UTILITY USE OF HIGH SULFUR EASTERN COALS. IN ITS NEXT ROUND OF SOLICITATIONS, THE DOE MUST DEVISE A STRATEGY TO INVOLVE MORE UTILITIES DIRECTLY IN THE PROGRAM.

THE NEXT ROUND OF FUNDING ALSO SHOULD BE DIRECTED TOWARD PROJECTS THAT WILL PROVIDE EXPERIENCE IN RETROFIT APPLICATIONS FOR EXISTING COAL-FIRED UTILITY BOILERS. THE CLEAN COAL PROGRAM HAD ITS ORIGINS IN THE PROBLEMS CAUSED BY SULFUR EMISSIONS OF EXISTING COAL-FIRED PLANTS AND THE DEARTH OF PROJECTS IN NEGOTIATIONS IN THE FIRST ROUND THAT WOULD ADDRESS THE PROBLEMS OF EXISTING COAL PLANTS IS AN OBVIOUS SHORTCOMING.

IN THIS REGARD, I APPLAUD THE LANGUAGE IN H.R. 5234, THE FISCAL 1987 INTERIOR AND RELATED AGENCY APPROPRIATIONS BILL PASSED BY THE HOUSE THAT CALLS UPON THE DOE TO TAKE THE FIRST STEPS IN SOLICITING EXPRESSIONS OF INTEREST BY INDUSTRY IN CLEAN COAL RETROFIT PROJECTS.

WHILE THE CLEAN COAL PROGRAM HAS MADE SATISFACTORY PROGRESS TO DATE, I DO HAVE SOME MISGIVINGS ABOUT THE LACK OF A SCHEDULE FOR COMPLETING NEGOTIATIONS FOR COOPERATIVE AGREEMENTS. I BELIEVE THAT ONE REASON FOR THE PROGRESS WE HAVE SEEN HAS BEEN THE STRICT TIMETABLES AND CLOSE OVERSIGHT OF THE PROGRAM BY THE CONGRESS. HOWEVER, THERE APPEARS TO BE NO DEADLINE PLACED UPON THE DOE OR PROJECT SPONSORS TO COME TO MUTUALLY AGREEABLE CONTRACT TERMS. WHILE I CAN APPRECIATE THAT THE CONGRESS IS HESITANT TO INTERFERE WITH THE NEGOTIATION PROCESS, THE PROGRAM WILL NOT BE WELL SERVED BY OPEN-ENDED NEGOTIATIONS. A REASONABLE

DEADLINE FOR THE PARTIES TO REACH AGREEMENT WOULD SERVE NOTICE TO ALL CONCERNED THAT THE CONGRESS INTENDS THAT THIS PROGRAM RESULT IN THE COMPLETION OF PROJECTS THAT GENERATE ELECTRICITY, NOT ENDLESS DISCUSSIONS THAT GENERATE PAPER.

FINALLY, I WOULD LIKE TO COMMENT BRIEFLY ON AN ISSUE BEYOND THE PURVIEW OF THE CLEAN COAL PROGRAM, BUT CRITICAL TO ITS SUCCESS -- ACID RAIN LEGISLATION PENDING BEFORE THE CONGRESS. BOTH INITIATIVES HAVE AS A GOAL REDUCING ATMOSPHERIC SULFUR EMISSIONS FROM COAL FIRED POWER PLANTS. THIS IS A GOAL TO WHICH ALL CAN SUBSCRIBE AND ONE WHICH CAN ULTIMATELY MAKE COAL A MORE ATTRACTIVE FUEL AND EXPAND THE MARKETS FOR ITS USE. YET IF THE TWO EFFORTS ARE TO WORK IN CONCERT, THE CONGRESS SHOULD BE CAREFUL THAT IN SETTING TIMETABLES FOR COMPLIANCE UNDER ANY ACID RAIN LEGISLATION, IT DOES NOT FORECLOSE NEW TECHNOLOGY OPTIONS FOR UTILITIES TO REDUCE SULFUR EMISSIONS. IF SULFUR REDUCTION COMPLIANCE DATES FOR EXISTING COAL-FIRED PLANTS ARE TOO EARLY, UTILITIES WILL EITHER USE EXISTING SCRUBBER TECHNOLOGY, SWITCH TO OIL OR GAS, OR SHUT PLANTS DOWN. NONE OF THESE OPTIONS INCLUDES INCORPORATING NEW CLEAN COAL TECHNOLOGIES. IF THE CLEAN COAL PROGRAM IS TO SERVE A PURPOSE IN BRINGING TO COMMERCIAL USE NEW TECHNOLOGIES FOR UTILITY SULFUR REDUCTION, TIME MUST BE ALLOWED TO DEMONSTRATE THE TECHNOLOGIES BEFORE SULFUR REDUCTION DEADLINES COME INTO EFFECT. THE DEMONSTRATION OF RETROFIT TECHNOLOGIES

ALSO TAKES ON ADDED IMPORTANCE IN THE FACE OF POTENTIAL ACID RAIN CONTROL LEGISLATION.

MR. CHAIRMAN, IN CLOSING I WOULD LIKE TO ASK THE MEMBERS OF THE COMMITTEE TO STEP BACK FOR A MOMENT FROM THE ISSUES OF CLEAN COAL, ACID RAIN, AND ELECTRICITY DEMAND GROWTH. THE LARGER ISSUE UNDER CONSIDERATION HERE IS ENERGY PREPAREDNESS FOR THE U.S. IN THE COMING DECADE. THE NATION IS AGAIN ON THE PATH TO DECREASED DOMESTIC OIL PRODUCTION, INCREASED DEMAND AND HIGHER RELIANCE ON IMPORTED OIL. THERE SHOULD BE NO DOUBT IN OUR MINDS THAT THE ENERGY FUTURE OF THE U.S. RELIES TO A LARGE DEGREE ON OUR DOMESTIC COAL RESERVES, NOT JUST FOR GENERATION OF ELECTRICITY, BUT ALSO FOR CHEMICALS AND TRANSPORTATION FUELS. BUT WE HAVE YET TO OVERCOME THE ECONOMIC, ENVIRONMENTAL, TECHNICAL AND POLITICAL BARRIERS STANDING IN THE WAY OF THE FULL REALIZATION OF COAL'S POTENTIAL.

THE CLEAN COAL PROGRAM OFFERS THE PROMISE OF REDUCING SOME OF THE BARRIERS TO INCREASED COAL USE. FOR THIS REASON ALONE CONGRESS MUST VIGOROUSLY OVERSEE THE MANAGEMENT OF THE CLEAN COAL PROGRAM AS AN ASSURANCE TO THE AMERICAN PEOPLE THAT THIS OPPORTUNITY WILL NOT BE LOST.

MR. CHAIRMAN, I WOULD BE HAPPY TO RESPOND TO ANY QUESTIONS YOU MAY HAVE.

Mr. BOUCHER. Mr. Henderson, we will be happy to hear from you.

STATEMENT OF CHARLES B. HENDERSON, SENIOR VICE PRESIDENT, RESEARCH AND TECHNOLOGY, ATLANTIC RESEARCH CORP., REPRESENTING CLEAN COAL TECHNOLOGY COALITION, INC.

Mr. HENDERSON. Thank you, Mr. Chairman. I'm Charles Henderson, senior vice president for research and technology of the Atlantic Research Corp. of Alexandria, VA. I'm speaking today on behalf of the Clean Coal Coalition. This is an advocacy group that was formed in 1983 to advance the application of technologies for the clean use of coal. The coalition appreciates the opportunity to present its views on implementation of the clean coal technology program.

The coalition is pleased to note that three of its members, the Consolidated Natural Gas Co., the Keeler/Dorr-Oliver Boiler Co., and the Pennsylvania Electric Co., are participants in the present Clean Coal Technology Program of the Department of Energy.

The coalition strongly supports the Clean Coal Technology Program as conceived by the Congress. It is a welcome initiative to solve air emission problems caused by coal combustion.

The coalition is disappointed, however, that none of the nine CCT projects selected for support involve precombustion coal cleaning, which we believe is the logical first step in any system for the control of sulfur dioxide emissions from coal-fired power plants. This is not meant to be a criticism of the projects selected. It may be that none of the coal cleaning projects were technically ready or that none could meet the 50-percent cost share constraints or that none were well written. Coal cleaning is, however, the universal clean coal retrofit technology since it can be applied to all coal-burning facilities, large or small, old, new or planned. This point is elaborated in an invited survey paper which was presented yesterday in Pittsburgh, and a copy of that's attached to my statement.

Apparently the coalition's opinion that the recent awards did not place sufficient emphasis on emission control measures applicable to existing power plants is shared by others, and we are pleased to note that both the House and Senate fiscal year 1987 Interior appropriations bills include provision of an additional $350 million to support a second round of clean coal technology programs to advance primarily retrofit technologies.

As the universally applicable retrofit technology, improved coal cleaning methods should merit high priority in the next round. In addition to advanced physical coal cleaning techniques, microbial methods now under development should be emphasized. My own company, the Atlantic Research Corp. is a leader in the development of microbial methods for removing organic sulfur from coal which it considers the key to permitting economical exploitation of our vast high-sulfur coal resources. While such methods are still in the development stage, we confidently expect them to become commercially available in the 1990's.

In the meantime, we note that atmospheric fluidized-bed boilers are now commercially available in the new utility size range, as exemplified by the 110-megawatt circulating FBC installation now under construction at the Nucla, Colorado Power station of the Colorado-Ute Electric Association. The Pyropower Corp., another coalition member, is supplying this boiler. Units such as this can meet new source performance standards for sulfur dioxide emissions while burning high-sulfur coal or coal-cleaning waste.

Finally, Mr. Chairman, we urge that the implementation of this congressional mandate emphasize three objectives:

First is to provide flexibility for achieving emission reduction targets, including combustion technologies, to address both existing sources and future stationary sources. The utilities and industries that depend on coal should have a choice. They need to have the capability of selecting one or more of several technologies that best meet their economic situation and the specific constraints of their site. I believe Mr. Yeager termed that an "array of technologies," and we agree with that.

The second objective should be to accelerate the implementation of conventional coal cleaning and available clean combustion technologies.

And, third, to promote the development of innovative coal cleaning and combustion technologies.

These objectives are in keeping with Congress's program. They address both the near term and the future environmental goals and emission reduction targets.

We urge that this committee express its support for the objectives we have proposed, and that it specifically recommend that any new round of projects include coal cleaning technologies as the most cost-effective approach for SO_2 emission reductions.

This completes my statement. Thank you.

[The prepared statement of Mr. Henderson follows:]

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Statement of

CHARLES B. HENDERSON
Senior Vice President, Research and Technology
Atlantic Research Corporation

On Behalf of the

CLEAN COAL COALITION, Inc.

Before the

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C.

September 10, 1986

Thank you, Mr. Chairman. I am Charles B. Henderson, Senior Vice President for Research and Technology of the Atlantic Research Corporation of Alexandria, Virginia. I am speaking today as the president of the Clean Coal Coalition, Inc., an advocacy group formed in 1983 to advance the application of technologies for the clean use of coal. The Coalition appreciates the opportunity to present its views on implementation of the Clean Coal Technology program.

The Coalition is pleased to note that three of its members, the Consolidated Natural Gas Company, the Keeler/Dorr-Oliver Boiler Company and the Pennsylvania Electric Company, are participants in the present Clean Coal Technology program of the Department of Energy.

"ENCOURAGING INNOVATIVE TECHNOLOGIES TO BURN COAL CLEANLY"

The Coalition strongly supports the Clean Coal Technology Program as conceived by the Congress. It is a welcome initiative to solve air emission problems caused by coal combustion. Unfortunately, as presently implemented, the program does not address these problems in a timely manner.

The Coalition is disappointed that none of the CCT projects selected for support involve precombustion coal cleaning, which is the logical first step in any system for control of sulfur dioxide emissions from coal-fired power plants. This is not meant to be a criticism of the projects selected. It may be that none of the coal cleaning projects were technically ready, or that none could meet the 50% cost share constraints, or that none of the coal cleaning proposals were well written. Coal cleaning is, however, the universal "clean coal retrofit" technology, since it can be applied to all coal-burning facilities, large or small, old, new or planned.

This point is elaborated in an invited, survey paper on the subject presented yesterday to the Third Pittsburgh Coal Conference by Dr. Leon Green, Jr., Vice President of the Coalition. A copy of Dr. Green's paper is attached to my statement for inclusion in the record.

Apparently the Coalition's opinion that the recent Clean Coal Technology awards did not place sufficient emphasis on emission control measures applicable to existing power plants is shared by others, and we are pleased to note that both the House and Senate FY '87 Interior Appropriations bills include provision of an additional $350 million to support a second round of Clean Coal Technology programs next year to advance "retrofit" technologies.

As the universally applicable retrofit technology, improved coal cleaning methods should merit high priority in the next round. In addition to advanced physical coal cleaning techniques, microbial methods now under development should be emphasized. My own company, the Atlantic Research Corporation, is a leader in the development of microbial methods for removing organic sulfur from coal which it considers the key to permitting economical exploitation of our vast high-sulfur coal resources. While such methods are still in the development stage, we confidently expect them to become commercially available in the 1990's.

In the meantime, we note that atmospheric fluidized-bed boilers are now commercially available in the "new utility size" range, as exemplified by the 110 MWe "circulating" FBC installation now under construction at the Nucla, Colorado station of the Colorado-Ute Electric Association by the Pyropower Corporation, another Coalition member. Units such as this can meet New Source Performance Standards for SO_2 emissions while during high-sulfur coal or coal-cleaning waste.

Finally, Mr. Chairman, we urge that the implementation of this Congressional mandate emphasize three objectives:

1. Provide flexibility for achieving emission reduction targets, including combustion technologies, to address both existing sources and future stationary sources. The utilities and industries that depend on coal should have a choice. They need to have the capability of selecting one or more of several technologies that best meet their economic situation and the specific constraints of their site.

2. Accelerate implementation of conventional coal cleaning and available clean combustion technologies; and,

3. Promote development of innovative coal cleaning and combustion technologies.

These objectives are in keeping with Congress's program. They address both near term and future environmental goals and emission reduction targets.

We urge that this Committee express support for the objectives we have proposed, and that it specifically recommend that any new round of projects include coal cleaning technologies as the most cost-effective approach for SO_2 emission reductions.

This completes by statement. I will be pleased to answer questions from the Subcommittee members and provide additional material for the record.

No. 82 COAL CLEANING: FIRST STEP TOWARD SULFUR CONTROL

L. GREEN, JR., Clean Coal Coalition, Inc., Washington, D.C.

ABSTRACT

Control of coal quality and de-ashing to reduce boiler slagging and fouling are no longer the prime motivations for coal preparation; they have been replaced by the environmental imperative to minimize emissions of sulfur dioxide from coal-fired power plants. However, the potential contributions of conventional physical coal cleaning toward this new end have been disparaged by proponents of flue gas scrubbing, and its true cost-effectiveness thus remains widely unrecognized. The operational benefits throughout the complete fuel cycle derivable from precombustion cleaning are noted, and further substantial economic benefits which will accrue from the deployment of fluidized waste-burning combustors at preparation sites are forecast. Application of these readily-available, commercial clean coal technologies can drastically cut, if not avoid, the excessive costs of meeting proposed emissions reduction goals projected by assuming use of flue gas scrubbing alone.

INTRODUCTION

> The full range of emerging clean coal technologies cannot be developed and deployed within the timetables for mandatory reductions now under discussion (1).

> The claim that we should delay acid rain controls to wait for "clean coal" results...is likely to weaken the "clean coal" program itself, by eroding the previous broad based political support for that program (2).

> Soon, the day of reconning [sic] will fall upon U.S. electric utility and industrial coal-fired boiler operators (3).

Inadvertent truth revealed by typographical error may be embarrassing, but truth it remains. Development of support in the House of Representatives sufficiently broad to appropriate funds for the $400 million Clean Coal Technology Reserve (CCTR) program required assuring members from "downwind" states that the program would produce early results in terms of reduced emissions of sulfur dioxide from coal-fired power plants in the upwind states. Now, "It is the burden of those who need this program most to (re)assure the swing votes - the downwind State and environmental legislators in Congress - they are getting what they voted for" (3), in particular technologies which can be retrofitted to existing boilers.

As this is written the demonstration projects selected by the Department of Energy for support under the CCTR program are not known, but it has been stated (2) that only about five of the 51 proposals received involve retrofit, and bills to repair this breach of political promise by appropriating another $350 million have been introduced. Such a response illustrates the too-common belief that the terms "technology" and "retrofit" refer only to equipment which can be mechanically coupled to a power plant, e.g., a flue gas desulfurization plant. It has generally been overlooked that the universally applicable clean coal retrofit technology is coal cleaning (4).

NEW MOTIVATION FOR COAL PREPARATION

The original motivation for the cleaning or preparation of coal was to lower the cost of its transportation by removing inert mineral matter, then accomplished by simple crushing and screening operations at the mine mouth. More recently, electric utility customers have demanded a higher level of preparation to reduce the mineral content still further and thus minimize slagging and fouling of their boilers. This investment in fuel quality control at the prep plant is rewarded at the power plant by improved boiler performance and availability, and hence reduced cost of generating electricity (5).

Such a cost saving has been documented in the case of the Muskingum River Generating Station of the Ohio Power Company, part of the American Electric Power Company, where the use of "fully washed" coal increased its capacity rating by 50 MWe. The value of this additional generating capacity to the utility system, based upon replacement cost, was $13.75 million per year, and the increase in plant availability of 5 percent was estimated to make nearly 625,000 additional megawatt-hours available yielding a pre-tax income at the busbar of $6 million annually (6). Physical coal cleaning is thus a negative cost step due to the de-ashing accomplished, not to the sulfur removal also realized thereby.

Too little recognized (especially by the advocates of coal "switching") is the corollary fact that even low-sulfur "compliance" coals still must be cleaned in the interest of high plant availability. This fact is illustrated by the experience of the Tanners Creek plant of the AEP system, which prior to 1973 showed an availability of 80.8 percent when fired on a high-sulfur run-of-mine Midwestern coal. When the plant was switched to a low-sulfur ROM coal its availability dropped to 70.3 percent. Cleaning the new coal reduced its sulfur content insignificantly (from about 0.6 to about 0.5 percent) but increased plant availability to 85.8 percent (7). Coal switching thus does not constitute the "least-cost" emission control measure it is sometimes touted to be.

Important as improved boiler performance and availability may be, the driving force behind wider application of coal-cleaning technology is the environmental imperative to reduce emissions of sulfur dioxide. Accordingly, the new basis for comparison of cleaning cost-effectiveness is no longer dollars per ton of clean coal but dollars per ton of SO2 removed. Even on this basis (which is clearly irrelevant for coals naturally low in sulfur content) physical coal cleaning is rated the least costly means of sulfur removal available (8,9), with flue gas scrubbing by far the most costly.

Although favorable, this evaluation still underestimates the true cost-effectiveness of coal cleaning; it lists only the cost of the prep plant and its operation but neglects to include the downstream reward at the power plant cited above.[1] The cost of conventional coal cleaning is thus presented as positive (although low) instead of negative. A typical example of such "innocent misrepresentation" is illustrated in Figure 1, which is a comparison of the cost and removal efficiencies of various emission control measures estimated by the Electric Power Research Institute (10).[2] Figure 1 also indicates that the upper limit of sulfur removal by physical coal cleaning is 30 percent, so it should be noted that this limit can extend up to 50 percent for readily "washable" coals with a high ratio of mineral (pyritic) sulfur to organic sulfur, such as those found in the northern Appalachian and eastern Midwest regions designated by the Bureau of Mines and characterized in Table I (11).

TABLE 1
Composite Raw Coal Characteristics
(Bureau of Mines, Report of Investigation 8118, 1976)

Region	Moisture (Per Cent)	Ash (Per Cent)	Sulfur Pyritic	(Per Cent) Total	Btu Per Pound (10^3)*
Northern Appalachian	1.7	15.1	2.01	3.01	12.7
Southern Appalachian	1.8	11.0	0.37	1.04	13.3
Alabama	1.4	9.5	0.69	1.33	13.7
Eastern Midwest	4.9	14.2	2.29	3.92	12.2
Western Midwest	4.0	16.2	3.58	5.25	12.1
Western	8.5**	8.9	0.23	0.68	12.4

*Moisture-free basis.
**May increase significantly during transportation to user.

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1. The above considerations do not include the substantial benefits to be derived from burning the cleaning waste, to be discussed later.

2. Figure 1 also indicates (by use of a dashed line) that atmospheric fluidized-bed combustor (AFBC) technology is in the developmental stage. As will be discussed later, the circulating FBC is fully commercial in the "new utility size."

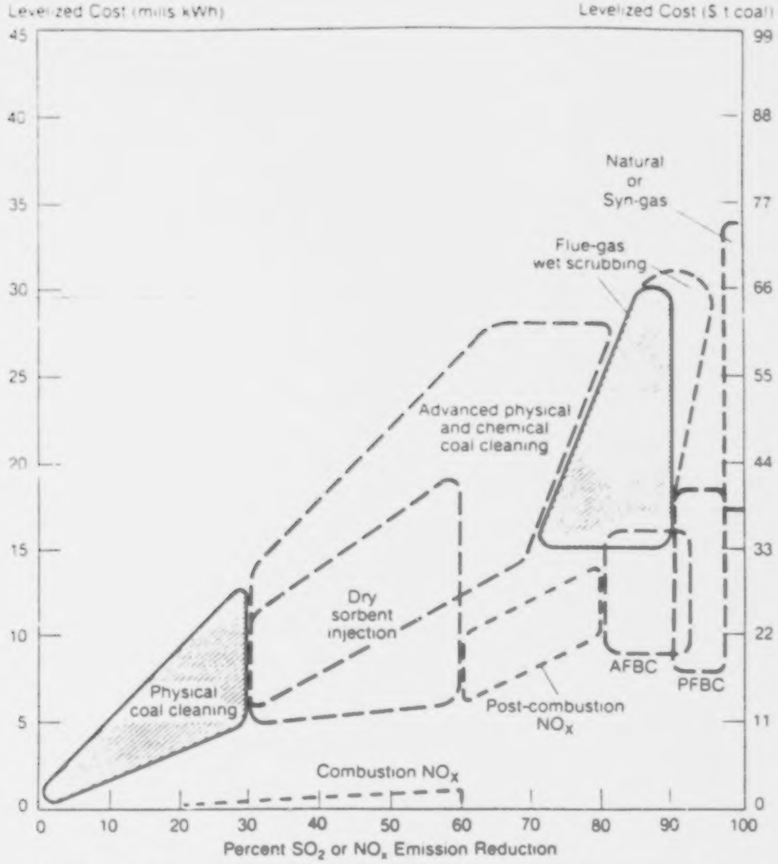

Figure 1. Comparison of cost and efficiency of various emission control measures estimated by the Electric Power Research Institute (Reference 10)

EMISSION CONTROL POTENTIAL OF COAL CLEANING

A 1981 study of the reduction in SO2 emissions achievable by physical coal cleaning (PCC) conducted for the U.S. Environmental Protection Agency indicated that conventional washing (crush to 1.5-inch top size, separate at 1.6 specific gravity) of all the utility coal delivered in 1979 from eight states comprising the four Bureau of Mines regions in the eastern U.S. could have achieved an additional reduction of 2.8 million tons SO2 above the amount actually realized that year by cleaning only part of it (12). Subsequently this appraisal was revised downward to about 2.5 million tons.

A more recent review of coal-cleaning technology (13) further reduced the above estimate to about 2.0 million tons but noted that use of fine coal cleaning (FCC: 14-mesh top size, 1.6 s.g. separation) could increase this amount substantially. Not quantified, however, was the higher cost of FCC due to increases in grinding power required and in loss of fine coal to waste, a cost which will tend to negate the downstream savings in terms of increased boiler performance and availability. Just where this point of diminishing returns is reached as the degree of coal comminution increases has not been established, but will be coal-specific and need not be known precisely if the waste-burning option is excercised, about which more later.

REGIONS OF GREATEST EFFECTIVENESS

The acid deposition issue has been marked by continuing scientific controversy regarding the complex atmospheric chemistry involved, the degree of linearity between cause and effect and "source-receptor" relationships (14). These questions may never be answered definitively enough to satisfy either the scientists or the equally interested (but for different reasons) parties who would further defer environmental action pending "more research." For most purposes, however, it is sufficient to observe that the receptor effects vary, roughly, in direct proportion to the strength of the SO2 source and inversely to its distance upwind of the affected location.

Reference to Figure 2 shows that the most important emitter states are those bordering the Ohio river, located directly upwind (on the average) of the northeastern region suffering the greatest acid deposition damage. Comparison with Table I shows that these same states are exactly the ones comprising the northern Appalachian and eastern Midwest regions whose coals are the most amenable to physical cleaning. This is indeed a fortunate coincidence; PCC can be most effectively employed just where reductions in SO2 emissions are most needed.

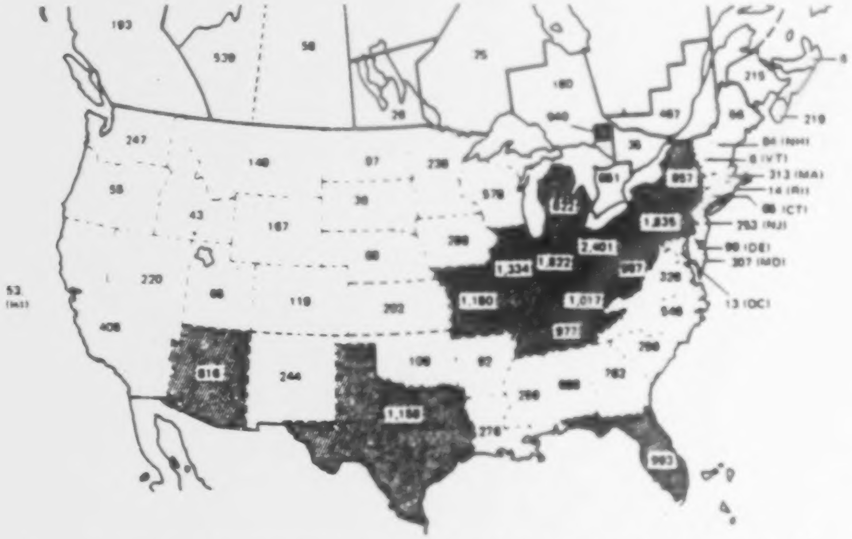

Figure 2. Representative values of SO_2 emissions in the United States and Canada in 1980, in thousands of tonnes (Reference 14)

Examination of Figure 2 also reveals that, in addition to the states in the northern Appalachian region (Ohio, Pennsylvania, northern West Virginia), New York is also a significant SO2 emitter. New York imports its coal, more than 80 percent of it from Pennsylvania with an average heat value of 12,045 Btu/lb and average sulfur content of 1.9 percent (or 3.15 lb SO2 per million Btu) (15). Because of their high SO2 emissions and close proximity upwind of the New England states most affected by acid precipitation, these four states constitute a regional group offering the best opportunity for a limited but definitive experiment to determine the contribution of SO2 emissions to acid deposition.

It should be recalled here that in 1983 the EPA proposed just such a "four-states test" of the effect of reducing SO2 emissions in Ohio, New York, Pennsylvania and West Virginia upon acid precipitation in the New England region immediately downwind. Because of Cabinet Council objections to high cost and predictions of perceived unfairness to the affected utility rate-payers of those states, however, the so-called "Ruckelshaus Option 3" plan was never implemented.

This political judgment was undoubtedly correct, for the emissions reductions were to be achieved by so-deemed "Best Available Control Technology" (see below), and to arbitrarily impose the high capital and operational costs of flue gas scrubbers selectively upon the utilities of four "scapegoat" states would indeed have been unconscionable.

In view of the favorable AEP experience cited earlier it appears appropriate here to suggest that, if the utilities involved had been permitted to choose the "negative-cost" control option available, i.e., full use of cleaned coal, they and their rate-payers could have benefited as a result of the experiment. Let me further suggest that it is still not too late to give the coal-cleaning approach a limited "Option 3" test. Should it be judged insufficient by itself to meet the desired goals, then more costly additional measures can be considered. No subsequent, positive-cost option favored by other interests will have thereby been precluded.

LIMITATIONS OF COAL CLEANING

The potential contribution of physical coal cleaning (PCC) has received occasional high-level recognition (16,17) but is usually dismissed as inadequate. The reason for this disparagement is that physical methods for removing mineral impurities are effective on pyritic sulfur but do not affect the organic component. Depending upon the particular coal, conventional cleaning can remove from 20 to 50 percent of the total sulfur (11) whereas a wet-sludge FGD system (when operating at peak performance) can remove up to 90 percent. This fact leads environmental utopians to demand "Why not the best?" and the call is echoed by a claque of scrubber constructors and high-sulfur coal producers. The environmental committees of both houses of Congress have been stampeded by this so-called "unholy alliance" into discounting the cost factor in the cost-benefit balance and writing the law of the land in the superlative degree: the Clean Air Act thus calls for "Best Available Control Technology" (BACT) and "Lowest Achievable Emission Rate" (LAER) without consideration of the costs involved.

Moreover, the Act is further rigged by specifying that BACT for control of sulfur dioxide emissions consists of "...a technological system of continuous emission reduction" (18), a phrase carefully crafted to mandate flue gas scrubbing. On the other hand, the New Source Performance Standards promulgated by the Environmental Protection Agency specifically recognize physical coal cleaning as a creditable step in complying with percentage reduction requirements on sulfur content (19). Let us hope that future amendment of the Clean Air Act will reconcile this apparent contradiction in language sufficiently unequivocal to permit application of alternative methods of emission control, including coal cleaning.

In the future improved sulfur removal may be achieved by advanced coal cleaning methods now under development (13), which include new physical separation techniques and chemical treatments to remove organic sulfur compounds, but as of now even their projected costs are not competitive. The most promising new possibility appears to be the development of microbial methods (20) for converting most organic sulfur to water-soluble inorganic form while retaining most of the volatile components desired for stable combustion. The commercial availability of these processes is still a decade away, but their immense potential for permitting exploitation of our vast high-sulfur coal resources warrants a vigorous development effort.

SEQUENTIAL SULFUR REMOVAL STEPS

Meanwhile, the present environmental imperative to reduce SO2 emissions from existing coal-fired power plants requires recourse to a range of alternative emission control options currently available (21) and, shortly, to additional ones now under full-scale commercial demonstration. The options immediately available are:

- o Precombustion coal cleaning
- o Fluidized-bed combustion (auxiliary)
- o Fuel switching or blending
- o Flue gas desulfurization (wet)

The additional options soon to be commercially available are:

- In-furnace sorbent injection
- Gas reburning (combined NOx control)
- Downstream in-duct sorbent injection
- Dry FGD (spray drying)

A sulfur control system employing the more "here now" of these various options would begin with coal cleaning or preparation, as indicated schematically in Figure 3. The more mineral matter (pyritic sulfur plus ash) removed in the upstream cleaning operation, the lower the solids loading in the furnace, the requirements for sulfur capture there and further downstream, and the burden of collecting and disposing of fine paticulates. In the case of readily "washable" coals the need for an FGD plant may be avoidable; even in the worst case the size and cost of such a plant will be minimized. Since the approach to optimization of the overall system is to be the subject of a later presentation (22) it will not be discussed further here.

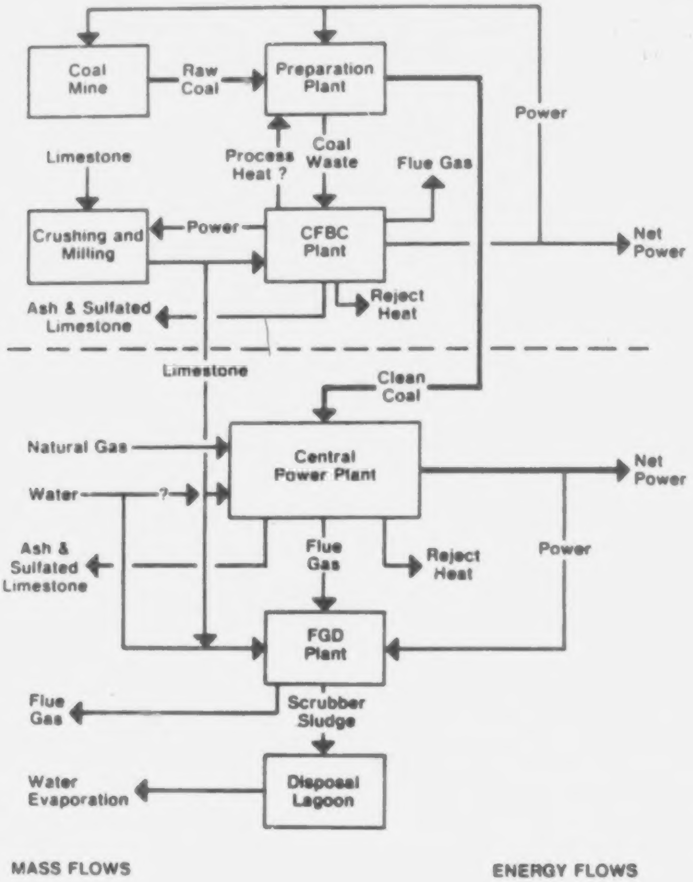
Coal Mine
Raw Coal
Preparation Plant
Power
Limestone
Process Heat ?
Coal Waste
Flue Gas
Crushing and Milling
Power
CFBC Plant
Net Power
Ash & Sulfated Limestone
Reject Heat
Limestone
Clean Coal
Natural Gas
Water
?
Central Power Plant
Net Power
Ash & Sulfated Limestone
Flue Gas
Reject Heat
Power
FGD Plant
Flue Gas
Scrubber Sludge
Water Evaporation
Disposal Lagoon
MASS FLOWS
ENERGY FLOWS

Figure 3. Possible components in an integrated sulfur control system for coal-fired power plants (Reference 22)

WASTE BURNING FOR AUXILIARY POWER

Also indicated in Figure 3 is a circulating fluidized-bed combustor[3] (CFBC) plant for burning the coal-cleaning waste, which can power the mining and preparation operations and sell its excess power to the local utility system (23). Since the CFBC plant will meet New Source Performance Standards for SO_2 emissions, its auxiliary power can compensate for the main-plant power consumed by any parasitic FGD plant (if necessary) and/or contribute to the net output required of the main power plant. Either way, the availability of "compliance power" from the CFBC plant can help reduce the amount of SO_2 which need be emitted by the main plant.

Among other simplifications, the system diagrammed in Figure 3 shows only two product streams from the preparation plant, so the "clean" stream is not NSPS compliance coal (1.2 lb SO_2 per million Btu). Otherwise the additional control measures downstream would not be required and the waste stream would be too large to be consumed by an "auxiliary" CFBC plant.

It is possible to produce a compliance coal by using a higher level of preparation such as that employed in the multi-stream coal cleaning (MSCC) plant at the Homer City, Pennsylvania generating station of the New York State Electric & Gas Corporation and the Pennsylvania Electric Company. By effective use of heavy-media cyclone separation the MSCC plant produces three streams: a compliance stream containing roughly one-third of the energy output; a "middlings" stream containing slightly more than 60 percent; and a waste stream containing the remainder (roughly 6 percent) of the energy.

Burning such a middlings stream (with more than 2 percent sulfur) directly in an existing PC-fired power plant would overwhelm the panoply of in-furnace sulfur-capturing defenses suggested in Figure 3 and still require an FGD plant. A possible alternative to the final scrubbing step might be to split the middlings stream by an added stage of fine grinding and froth flotation, with the additional waste directed to the circulating flow combustor. The size of this "auxiliary" CFC plant would indeed become substantial, but it would constitute a long-lived, productive investment rather than a short-lived, parasitic appendage requiring careful maintenance and frequent replacement of corroded components.

CONCLUSION

The foregoing discussion has pointed out that the most cost-effective method of controlling sulfur dioxide emissions from existing coal-fired power plants involves application of multiple control measures rather than depending upon any single one, such as flue gas scrubbing. Because of its favorable economic effects upon the performance, availability and life of a downstream power plant, precombustion coal cleaning or preparation is the preferred first step in any sequence of such control measures.

The nature of the subsequent measures and the emphasis they merit in the downstream sequence of applications will be specific to each installation (by age, design, site, coal sources, etc.) and the optimum, least-cost mix can best be determined by the individual plant operator. For the past three years the Clean Coal Coalition has advocated "freedom of choice" by the operator among multiple available control options and combinations thereof. It is now pleased to note that such flexibility is also endorsed by a major environmental group (24).

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[3] In order to correct the impression given by Figure 1 that atmospheric fluidized-bed combustor (AFBC) technology is still in the developmental stage, it should be understood that this assessment by the Electric Power Research Institute applied only to the "bubbling-bed" FBC design which until recently was commercially available only in industrial-size units. Since that time a 125-MWe bubbling FBC has started operation at the Black Dog station of the Northern States Power Company. The so-called "circulating fluidized bed" (or, more precisely, "circulating flow") combustor has been in heavy industrial service since 1981 and entered utility service in 1985. The first U.S. utility CFC installation, a 110-MWe unit at the Nucla station of the Colorado-Ute Electric Association, is scheduled to start up in 1987. Still larger CFC units within the "bite-size" range of 100 to 200 MWe now preferred by utilities for new increments of added generating capacity are under contract.

For purpose of analysis to determine least-cost control combinations, a model incorporating the principal commercially available or near-term techniques for SO2 capture has been proposed and a specific site for its trial application suggested. As the first step in each likely combination, upstream coal cleaning is an essential economic component. Similarly important, it appears, may also be utilization of the cleaning waste for generation of usable and saleable auxiliary power.

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Mr. Boucher. Thank you, Mr. Henderson.

Mr. McCormick, we'll be happy to hear from you.

STATEMENT OF JOHN McCORMICK, ENVIRONMENTAL POLICY INSTITUTE

Mr. McCormick. Mr. Chairman, I'm John McCormick, and I'm with the Environmental Policy Institute in Washington, DC. It's a pleasure to appear before this subcommittee this morning to discuss an issue of immediate importance.

Mr. Chairman, I'm embarrassed to say that I don't have a written statement. I'd like to say that my dog chewed up my homework, but in this technologic age I'm embarrassed to say that my computer devoured my testimony. But I will provide written testimony to this subcommittee at my earliest opportunity.

Mr. Boucher. Well, without objection, it will be received.

Mr. McCormick. Thank you, Mr. Chairman.

Mr. Chairman, the Environmental Policy Institute and the Izaak Walton League supported wholeheartedly the $750 million Clean Coal Technology Reserve because the House and Senate Appropriations Committee members met several of our very strong objections that the initial program had very little in the way of guidelines, and with your help and the help of Congressman Doug Walgren we managed to get some very specific guidelines into the Senate language. Unfortunately, they weren't really mirrored in the Department of Energy's PON document, and there were other problems with the early implementation of the clean coal technology program; and the net result, Mr. Chairman, is that we find ourselves in a difficult position of not wanting to say that those who supported the Clean Coal Technology Reserve's initial $400 million have been taken in because there are some projects in this list of nine that are worthy candidates for funding. However, we had hoped that the greater emphasis would have been given to emission reduction retrofit technology and certainly not to projects the likes of which include underground coal gasification.

So, Mr. Chairman, we have the burden now of going back to those swing votes, the votes who are very much in support of acid rain control, and say, no, we didn't get everything we want, but we can be assured that phase two will give us precisely what we want if the Congress will take control of phase two. And I'd like to make a recommendation, Mr. Chairman, and discuss it further with the subcommittee in anticipation of the House and Senate vote on the conference report of the fiscal year 1987 Interior appropriation. I think we really should take a good close look at the language in those two bills.

My proposal, Mr. Chairman, would be to say let's decide before we approve the appropriation for phase 2 what it is we want to demonstrate. Now there is a fixed list of technologies that are ready for commercial demonstration, and I believe that EPRI, the Energy Research Advisory Board of DOE, EPA, and Jack Siegel's group at DOE know precisely what those technologies are and they are very familiar with them. For one, the Energy Research Advisory Board provided to DOE a very substantial report on what is out there in terms of clean-coal technology. Department, excuse me, the Energy Research—the Electric—EPRI, excuse me. EPRI supplied to that DOE solicitation a total of about $1.9 billion of technology proposals and the cost sharing provided in that totaled about $750 million. If the full $750 million was devoted to the EPRI solicitations, I believe we'd have a marvelous program to offer to the Nation's utility and industrial boiler operators.

So my proposal, Mr. Chairman, is that the Congress authorize the establishment of a working committee—which would include members of ERAB, particularly Dr. Eric Reichl; EPRI, Kurt Yeager; EPA, Frank Princiata, perhaps; and Jack Siegel's group at DOE—and have this group meet to discuss the list of yet to be demonstrated, emission reduction, retrofit technologies, the technologies that this group feels should be provided funding. And then have DOE issue an RFP to boiler operators to urge them to host a boiler for that specific technology. Let the boiler operator and the inventor work out the engineering and the cost arrangements, bring that information back to DOE, and have DOE submit to the Congress a specific list of emission reduction, retrofit technologies that this working group feels is in the best interest of the coal, utility, and industrial sectors. And then have the Congress approve funding for that list.

Now I could assure you, Mr. Chairman, that we could find the votes to support that phase 2. I really doubt that we could find the votes to support a phase 2 that just opens again a notice for submittal of proposals and go through the same routine that the Department of Energy went in phase 1.

I will say, though, Mr. Chairman, that we should commend the work of Jack Siegel and his group in their meeting the deadline, and our hope is that they continue to adhere to a tight deadline and provide to the Congress the final arrangements. But then, Mr. Chairman, I would hope that the Congress would look very seriously at those, the final financial agreements and question very seriously projects such as underground coal gasification.

But in sum, Mr. Chairman, I think we're on the way, we shouldn't stop in midcourse, but if we don't see a more specific emissions, reduction retrofit phase 2, then my organization and others that I can urge will come to the Congress with the message that it's not worth going the second step and don't waste the taxpayers' money.

Thank you, Mr. Chairman.

Mr. **Boucher**. Thank you very much, Mr. McCormick. You did quite well even without a prepared statement.

PANEL 2 DISCUSSION

I want to thank each of the witnesses for being with us today.

Gentlemen, I would like to have your comments on whether you think that the projects DOE selected cover a broad enough range of coal technologies to ensure a sufficiently broad utilization of our coal resources. And you can comment on that as you like. I'd appreciate hearing from each of you.

Mr. **Koleda**. Well, without being specific on them, I'd simply repeat my testimony that we feel that at the moment there is not enough emphasis on precombustion and post-combustion and on retrofittable technologies. And I think everyone has said that today, and I would agree with that.

Mr. BOUCHER. Mr. Henderson?

Mr. HENDERSON. I certainly agree. I believe my written testimony emphasizes that fact, and we just feel that precombustion—coal cleaning has to be pushed much harder than it is right now.

Mr. BOUCHER. Mr. McCormick?

Mr. McCORMICK. I'm afraid we find that it's too broad, Mr. Chairman, and I believe that some of these projects clearly could be eliminated and I don't think the Nation would suffer any consequences.

Mr. BOUCHER. How about pre- and post-combustion technologies, should they be included in the awards as well?

Mr. McCORMICK. Well, most definitely, Mr. Chairman. I'm very much in support of pre- and post-combustion technologies.

Mr. BOUCHER. In the second round of solicitations with a view toward advancing retrofit technologies, will there be a role for pre- and post-combustion technologies as well? Can coal cleaning technologies, for example, be included as you see the retrofit solicitation presently being structured?

Mr. Henderson, would you like to comment?

Mr. HENDERSON. Well, I'm not sure that I'm really aware of how that's being structured, but I'd certainly believe that the technologies are ready. In fact, I think some of the backup programs, one or two of the backup programs, fit that category already, and I would hope that those plus others that they didn't meet the first round could be considered. I think the technologies will be ready, and I would hope that Congress would push to see that that takes place.

Mr. BOUCHER. So in that view, we could use this second round of solicitations as a means to correct the oversight that was made by DOE in omitting both pre- and post-combustion technologies in the first phase?

Mr. HENDERSON. I'm not sure I'd use the word "oversight," but it's certain they're absent and I would hope that that would be—that what you say would come to pass.

Mr. BOUCHER. Mr. McCormick, I just have one additional question, and then I'll yield to my colleague, Mr. Bruce. You had commented to some extent on the acid rain problem in your opening statement. I wonder if the environmental community in general could be persuaded that an effective Clean Coal Technology Demonstration Program, such as what we hope this will turn out to be, could serve as an alternative for the adoption by the Congress of other kinds of acid rain legislation: raising emission requirements and providing a possible means of solving that. Would you care to comment on that?

Mr. McCORMICK. I'm afraid, Mr. Chairman, that combining the two issues is likely going to have the negative effect of drawing support away from the Clean Coal Technology Demonstration Program. My concern, Mr. Chairman, is that those who would use the argument "let's make sure that we've provided a long enough implementation period in the Acid Rain Mitigation Program to allow clean-coal technologies to prove themselves up" is a way of saying let's delay implementation and use clean coal as the way to do it.

That's going to turn the pro-acid-rain control votes against Clean Coal Technology Reserve, and I would urge anyone who feels that their process needs Federal funding to persuade their colleagues not to go in that direction because it's a certain way to defeat the purpose of the Clean Coal Technology Reserve.

Mr. **Boucher**. Gentlemen, that concludes the questions of you. Mr. Bruce.

Mr. **Bruce**. No questions.

Mr. **Boucher**. Staff has asked that one additional question be propounded, and any who care to answer may. With regard to the $350 million which is proposed for the second round of clean coal technology programs, what are your views on the need for recoupment of project cost from the revenues in that second round? We have as a part of the first round a requirement that to the extent that a profit is realized from the use of the technology that there be a repayment of the amount to the Federal Government. Do you think that's appropriate for the second round? And if so, why? If not, why?

Mr. **Koleda**. Well, I'd just say that a number of the members of our organization have told me that they believe that that recoupment provision has prevented projects that are desirable from coming forward. That it has been a problem.

The second point I'd make is, I'm persuaded by some of the testimony we have heard today that in the next round there be careful attention to exactly what are the objectives of the program and then to handle the financial arrangements around the $3 million; that is, recoupment or not, so as to get those objectives achieved. I think that's very important.

Mr. **Boucher**. Any other comments? Mr. Henderson.

Mr. **Henderson**. Well, speaking on behalf of my company instead of the coalition, I have no objections to the recoupment. I think it's actually appropriate that some repayment should be made in the future if profits are made.

I think it was not really written very well in the PON that came forth, and I would hope that that would be clarified. But no basic objections to the strategy of it.

Mr. **Boucher**. What about the argument, however, that the presence of a recoupment requirement has depressed the number, and perhaps the quality, of applications for funding?

Mr. **Henderson**. I would hope that that would not be true.

Mr. **Boucher**. Do you think it was true in the first round?

Mr. **Henderson**. I think that there probably were some, that it did happen to some extent that way.

Mr. **Boucher**. Mr. McCormick.

Mr. **McCormick**. Well, speaking as a neofiscal conservative, Mr. Chairman, I would say that—and I agree with Mr. Henderson—recoupment, unless there is a serious hardship that presented DOE would make recoupment the issue that would have the applicant withdraw the application. In most cases I think recoupment is justified.

And I would also suggest, Mr. Chairman, that the recouped dollars be plowed back into the Clean Coal Technology Reserve and continue to promote the demonstration of commercially available technologies be they emission reduction or retrofit.

Mr. **Boucher**. That's a very good suggestion, and we thank you for it.

Gentlemen, that concludes today's testimony.

This subcommittee will convene at 9:30 in the morning for a second day of hearings on the Clean Coal Technology Reserve. And until that time the subcommittee stands adjourned.

[Whereupon, at 11:58 a.m., the subcommittee was recessed, to reconvene at 9:30 a.m., Thursday, September 11, 1986.]

ASSESSMENT OF DOE'S CLEAN COAL TECHNOLOGY SOLICITATION

THURSDAY, SEPTEMBER 11, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Energy Development and Applications,
Washington, DC.

The subcommittee met, pursuant to recess, at 9:40 a.m., in room 2318, Rayburn House Office Building, Hon. Doug Walgren (acting chairman) presiding.

Mr. Walgren. Well, let me call us to order and start the proceedings.

As you know, this hearing continues the one yesterday in which our committee is gathering testimony and following with real interest the development of the clean coal technology solicitation under the program that the Department of Energy is now engaged in. This is a particular program that many of us take great pride in in the Congress because we feel it is a response to a very real gap that had been developing in our DOE programs over these several years, and also is addressed to solving a problem that is fundamental to our future manufacturing economy. So there is nothing that has a greater interest among members of the committee than the pursuit of this Clean Coal Technology Program.

Today we will hear from a number of firms that have started the process of negotiating with the Department of Energy about specific projects that are very promising, and we will hear from others who also engaged in the solicitation but have not been brought to that point.

In any event, we have broken you up into three panels. The first panel: Bert Zauderer, president of Clean Coal Technology Corp.; Dr. Womack, vice president of research and development and contract of the research division of Babcock & Wilcox; and Dr. Michael Heap of the Energy and Environmental Research Corp.

Let me, if I could, invite you gentlemen to come forward, and at the same time turn to my colleague from Ohio and ask for any opening comments that he might want to make.

Mr. Traficant. Thank you, Mr. Chairman. I am glad to see that our hearings are moving forward in this very important area. There are very fine companies here being represented by their executive officers, and excellent technologies, many of them that have proven to be cost-effective and perhaps America can become more energy independent by the programs that we are embarking upon here.

I would also like to say that the State of Ohio has developed a fund also that would work in partnership with the Federal Government to clean up coal. As you know, Ohio has been blamed as the culprit for the seedbed of acid rain, being the high-sulfur content of our coal. We have over from 10 to 15 billion tons of coal reserves in the State of Ohio. Much of it goes unused, with Ohio being a net importer of coal.

So I believe that the technology that we are hearing about today and the types of programs that DOE is embarking upon and that Congress is beginning to prioritize will show well not only for the State of Ohio but for the country on both our environmental concerns and our energy dependence on other nations, which I believe is critical to the national security of our country.

We are glad to be here and receive the many fine people who will be represented in testifying, and to be here with you today, Mr. Chairman.

Mr. WALGREN. I appreciate that statement.

Let me also recognize Mr. Fawell from the State of Illinois for any comments he might wish to make.

Mr. FAWELL. I have no opening statement, Mr. Chairman.

Mr. WALGREN. Well, gentlemen, we will proceed then with your testimony. Your written statements will be made part of the full record and you can feel free to select parts of them or communicate and underscore the points that you would like to make in whatever way you would feel them most effective.

We have something in the range of 10 minutes for each of you, and we are very interested in your experiences with this program, where you see the pitfalls ahead of you, what should we be thinking about in advance in our own interaction with DOE in hopes of reaching the kinds of understandings about how this program is to be implemented that would be proper, from your point of view, and most helpful. So we are very interested in your experience, and let's start first then with Mr. Zauderer.

Pull that mike in and it has a switch there.

STATEMENT OF DR. BERT ZAUDERER, PRESIDENT, CLEAN COAL TECHNOLOGY CORP.

Dr. ZAUDERER. Thank you. Mr. Chairman, members of the committee, ladies and gentlemen, I am Bert Zauderer, president of Coal Tech Corp., a small energy R&D company located in Marion, PA. Thank you for inviting me to testify before your committee on the Department of Energy's clean coal programs and on Coal Tech's project, demonstration of an advanced cyclone coal combustor with internal sulfur, nitrogen, and ash control for the conversion of a small oil-fired boiler to coal.

This was selected by DOE for negotiation of a contract. In my prepared remarks I will briefly describe the technology and background of this combustor, its potential to reduce nitrogen and sulfur dioxide emissions to meet the EPA's new source performance standards with most U.S. coals, its application to the retrofit or conversion of existing oil- and coal-fired boilers in the United States; and then I will briefly describe the project in its relationship to the DOE coal program.

Let me just briefly turn to the combustor technology. This project represents, in our opinion, the final step in the decade-long development of this combustor, which originated in a research and development group that I directed in the late 1970's and was engaged in another energy technology called magnetohydrodynamic power generation, or MHD, for short. A requirement arose for a high-ash-retention coal combustor, and we designed and fabricated and tested a small unit, rated at only 1 million Btu's, about 1 foot in diameter, under DOE sponsorship, and we removed about 90 percent of the ash inside the coal.

This led to some interest as to whether this could be used for boiler conversion from oil to coal, in view of the high oil prices at that time, and in a project that was sponsored by the Southern California Edison Co., with a low-sulfur Utah coal, we were able to reduce the nitrogen oxide emissions by 75 percent. A figure in the text shows how that was accomplished.

Next, we injected some limestone, out of scientific curiosity, to see whether we could do something with the sulfur, because the scientific theory of this combustor said that it should not work. And to our big surprise, we did get a very modest reduction, but under very unfavorable conditions. At that time, the testing effort was stopped.

The promise of these tests and the potential market for coal conversions of oil-fired equipment led me to form Coal Tech in 1981 to continue development of this combustor. After several years of research, we discovered and patented the processes which we believed to be responsible for the sulfur dioxide control function in this unit. In the text we have a figure which shows what this combustor looks like. It's basically a cylindrical can where you inject powdered coal at one end and limestone.

The combustor works in a sort of a cyclonic swirling action, removing the ash and the sulfur particles from the unit and the clean gas leaves the combustor and goes into the boiler, where it is used to raise steam.

Now, one of the novel features of this unit is that it is very easy to attach this to existing boilers. In the figure in the text, we have a photograph—a sketch, an engineering drawing—showing how this unit is attached to a 230 million Btu-per-hour oil-fired industrial boiler, which is a fairly large industrial unit, using the existing oil port.

Now, in the last several years, we developed design concepts for the attachment of these combustor to specific industrial boilers that we looked at, in a capacity range from small commercial of 23 million to 200 million Btu's per hour.

We have also studied, for several utilities, the conversion of their boilers in the 125,000-kilowatt to 600,000-kilowatt range, which is about the largest utility boilers in existence, with most boilers, we found very little or, at most, a very modest amount of modification to the walls of the boilers would be required.

The unit would be modularized, which means it can be mass produced in the factory and shipped on trucks at the 150 million Btu per hour level, or that may even be increased. We are not certain yet what the upper range is.

In the fall of 1984, Coal Tech received a Department of Energy contract to validate our sulfur and nitrogen oxide control features, with a small unit, a 7 million Btu per hour cyclone combustor at the Argonne National Laboratory.

In a series of tests in the last 9 months, with a low-sulfur West Virginia coal, a medium-sulfur Illinois coal, and a high-sulfur Illinois coal, which is representative of the high-sulfur coals in Ohio, Pennsylvania, and elsewhere in the United States, we have obtained up to 70 to 90 percent reduction in the sulfur dioxide emissions, which meets, in our opinion, the new source performance standards.

In the prepared text there is a figure which shows how the phenomena that we have discovered that relates the operation of this combustor to its sulfur control features. And we feel that we know that the interesting aspect of this result is that the maximum SO_2 reduction is also simultaneously the same point where we get the maximum nitrogen dioxide reduction. So we feel that the technical basis for the combustor attaining environmentally acceptable emission standards, has been mostly demonstrated at the laboratory level.

I will now turn to the DOE clean coal program. The most economical fuel use in the cyclone combustor is dry, pulverized coal. Economic considerations dictate that only boilers at the 100 million Btu per hour rating can justify the installed cost of coal pulverizing equipment. However, the present Coal Tech project, which is focused on a 23 million Btu per hour boiler, is designed to demonstrate the use of offsite coal pulverization of fine coal waste products from coal treatment or coal washing plants, which allows the economical use of coal even in small boilers.

The clean coal project, which is a 1,000-hour test, with 4 percent sulfur Pennsylvania coals and a low-sulfur Utah coal, represents the final phase in a development effort of this combustor at this scale. The first phase began in September 1984, with the design of the combustor by Coal Tech in Merion, PA. The second phase was completed February 1986 with the fabrication of the combustor in a specialty manufacturing company in Hazleton, PA.

The project is at this moment in the third phase, which will consist of a series of short-duration tests on an industrial boiler located in Williamsport, PA, where we will shake down the unit and determine its operating characteristics.

The following organizations have sponsored the first three phases of the project: Coal Tech Corp.; Southern California Edison Co.; Pennsylvania Power & Light; Philadelphia Electric, Houston Lighting & Power; a major oil company; the Ben Franklin Partnership Program of the State of Pennsylvania, which supports advanced technology and development in the State; Pennsylvania State University; the Pennsylvania Energy Development Authority, which provides assistance for the development of the State coal resources in an environmentally acceptable manner; and the Department of Energy, which will also contribute to phase III of the project.

Now, for the clean coal project, Coal Tech has requested that the Department provide 50 percent of the costs of the proposed 1,000-hour test, with the remaining costs to be provided by the Pennsylvania Energy Development Authority, the Southern California Edison Co., Pennsylvania Power & Light Co., and Coal Tech.

At the conclusion of this program, we plan to market the combustor for the retrofit of existing industrial boilers from oil to coal, using offsite pulverization of coal with specialized low-cost sources of finely ground coal wastes which have a high-sulfur content. We estimate that such applications would be competitive with oil in the $10 to $15 per barrel range.

At the same time, we propose to team with a utility to demonstrate the combustor at the utility size. We already have a design of a 100 million Btu per hour unit that is ready for fabrication, and depending on the environmental regulations at the time of the completion of the proposed project, the utility-size combustor would find application to oil-fired boiler retrofits or coal-fired retrofits to meet emission standards.

Based on our experience with the manufacturing costs of this cyclone combustor and its installation on the current 23 million Btu per hour boiler, we estimate that the use of this combustor on existing coal-fired boilers, assuming 100 million Btu per hour modular size, will cost about $30 to $50 per kilowatt installed.

In addition, our experience to date with four widely different coals suggests that almost any U.S. coal is suitable for this technology. Therefore, potential market for this combustor could well exceed 10,000 units.

With regard to the DOE coal program, I strongly support the aims of the program and its emphasis on a joint effort by Federal, State, and private sector participation. In view of the fact that new technologies take a very long time to develop, I believe that Government participation is absolutely essential, and I believe that at this period of low oil prices we should take the opportunity to develop new technologies so that they are ready for the marketplace if there is any significant increase in the price of oil.

However, irrespective of current oil and future oil prices, I believe that coal technologies that are capital intensive, such as the retrofit of existing equipment, should have an economic advantage over new plants, and that is the reason for our enthusiasm for this combustor.

In view of the diversity of the projects that were selected for this program by DOE, I hope that the contract can be awarded as soon as negotiations are complete for each contract, especially for the smaller projects. In Coal Tech's case, any significant delay between our current phase III test and the Clean Coal Program will be very costly to us.

Thank you for inviting me to appear before the committee, and I would be very happy to answer any questions.

[The prepared statement of Dr. Zauderer follows:]

September 11,1986

Testimony by Dr.Bert Zauderer, Coal Tech Corp.,Merion,PA 19066

to the U.S.House of Representatives, Committee on Science and Technology, Subcommittee on Energy Development and Applications

on the Subject of the Department of Energy's CLEAN COAL PROGRAM

and Coal Tech's Project entitled: THE DEMONSTRATION OF AN ADVANCED CYCLONE COAL COMBUSTOR, WITH INTERNAL SULFUR,NITROGEN, AND ASH CONTROL, FOR THE CONVERSION OF A 23 MMBTU/HOUR BOILER TO COAL

Mr.Chairman,members of the Committee, ladies and gentlemen. Thank you for inviting me to testify before your Committee on the Department of Energy's CLEAN COAL Program and on Coal Tech's Project "THE DEMONSTRATION OF AN ADVANCED CYCLONE COAL COMBUSTOR, WITH INTERNAL SULFUR,NITROGEN, AND ASH CONTROL, FOR THE CONVERSION OF A 23 MMBTU/HOUR BOILER TO COAL", which was selected by DOE for negotiation of a contract.

In my prepared remarks, I will briefly describe

the technology of the Coal Tech combustor;

its potential to reduce NO_x and SO_2 emissions to meet New Source Performance Standards with many US coals;

and its application to the "retrofit" of existing industrial and utility boilers to coal.

I will then describe the present project;

its importance in commercializing this technology;

and its relationship to the DOE Clean Coal Program.

Let me turn to the combustor technology.

The present DOE Clean Coal sponsored project is the final step in a decade long development effort on this combustor. It originated in an R&D group, that I directed in the late 1970's, which was engaged in the development of an energy technology, called magnetohydrodynamic power (MHD) power generation. A requirement arose for a high ash retention coal combustor. We designed, fabricated and tested a small 1 million BTU/hr combustor, under DOE sponsorship, and obtained up to 90% ash retention in the combustor.

In a further series of tests in 1980 in a low sulfur, Utah coal, we observed that up to 75% NO_x reductions could be achieved to levels much below New Source Performance Standards. As shown in figure 1, this was achieved by burning the coal inside the combustor with only 65 to 70% of the air flow required from complete combustion. The balance of the combustion took place in a second chamber downstream of the combustor, which simulated the boiler to which the combustor would be retrofitted.

We injected limestone in the combustor to see if the sulfur could also be reduced. Little reduction was expected because the gas temperature in this combustor is much too high for effective capture. To our surprise, the SO_2 emissions were reduced by one-third. Before, any further tests could be performed the entire group was disbanded in 1981. Coal Tech was formed in 1981, to continue the development of the combustor.

After several analytical studies, we discovered and patented the processes that we believed to be responsible for the observed SO_2 reduction. We also invented and patented, the novel air cooled coal combustor, which was designed to achieve simultaneously high NO_x and SO_2 reductions, while at the same time retaining 90% of more of the ash.

The main features of this combustor, which will be used in the planned Clean Coal Program, are shown in figure 2. The combustor is internally lined with a ceramic cylinder backed by an air cooled, metal tube assembly. Finely ground, pulverized coal and limestone particles and combustion air are injected through the end wall of the combustor on the left side of the figure. Coal particle combustion takes place in a region favorable to particle retention in the combustor, as well as NO_x reduction and sulfur capture in the combustor.

The novel aspect of this combustor is that both the liquid ash droplets, as well as the limestone particles after reacting and capturing the sulfur emitted by the coal, are embedded in the liquid ash layer lining the inner wall of the combustor. The use of air cooling in the combustor allows the rapid removal of this liquid ash and limestone mixture, through a drainage port located at the bottom of the unit. Therefore, a nearly particulate free, hot gas leaves the combustor for the boiler. The combustor is attached to the boiler in the manner shown in figure 3. The advantage of a clean gas exhaust is that no significant concentrations of liquid ash and limestone droplets will enter the boiler to deposit and corrode the surfaces in the boiler. Therefore, this combustor can be used with almost any US coal.

Coal Tech has developed design concepts for the attachment of these combustors to specific industrial boilers in capacity range from 23 to 230 million BTU/hour, and to utility boilers in the capacity range of 125,000 kilowatts to 600,000 kw. With most boilers, no modifications to the existing metal walls of the boiler are required. In boiler sizes up to about 150 million BTU/hour, one combustor is required. Above this size range multiple units will probably be required. The exact upper capacity for a single combustor is as yet undetermined.

In the Fall of 1984, Coal Tech received a contract from DOE to experimentally validate SO_2 and NO_x control cyclone coal combustors. For this purpose a 7 million BTU/hour capacity combustor located at the Argonne National Laboratory in Illinois was used. In a series of tests were performed in ~~in~~ the past 9 months, with a low sulfur West Virgina coal, a medium sulfur Illinois coal, and a high sulfur Illinois coal. Limestone was injected at several locations in the each of two stages of the combustor.

To date the important results have been that between 70 to over 90% reductions in SO_2 were measured in the first two coals. We have not yet analyzed the results with the third coal. Of even greater significance is that it has been possible to correlate the SO_2 reduction to the degree of air to fuel mixture in the first combustor stage. This correlation is nearly independently of the coal. This results which is shown in figure 4. The most recent high sulfur coal tests appear also to fall on this curve. This correlation suggests, pending validation with further tests, that one can set the combustor operating conditions for maximum SO_2 reduction, and achieve SO_2 reductions that meet New Source Performance Standards.

Another very important result is that maximum SO_2 reduction appears to take place at the same fuel to air mixture range that results in a maximum NO_x reduction. This provides important confirmation that both compounds can be simultaneously removed from the gas exhaust.

I will now turn to the proposed DOE Clean Coal Program with this combustor.

The most economical fuel for use in the cyclone combustor is dry pulverized coal. Economic considerations dictate that only boilers at 100 MMBTU/hr rating or greater, can justify the installed cost of coal pulverization equipment. However, the present Coal Tech project, which is focussed on a 23 MMBTU/hr boiler is designed to demonstrate that the use of off-site coal pulverization,or the use of fine coal waste products from coal treatment or coal washing plants, allows the economical use of coal in small industrial boilers.

The Clean Coal Project, which consists of a 1000 hour test effort,using a 2% and 4% Pennsylvania Freeport Seam coal and a low sulfur Utah coal, represents the final Phase in the development of this combustor at the 23 to 30 MMBTU/hr commercial scale. The first phase of the project began on September 1, 1984,with the design of the combustor by Coal Tech in Merion,PA.

The second phase in which the combustor was fabricated was completed in February 1986 by sub-contractors to Coal Tech. Most of the combustor's fabrication was performed by a specialty machine and metal fabrication company in Hazleton,PA.

The project is currently in Phase 3, the parametric test phase, which will consist of a series of short one day duration parametric tests designed to verify the combustor's performance,with primary emphasis on the air cooling design and the sulfur control feature of the combustor. For this purpose,a coal water slurry fuel will be used. The Phase 3 test effort will take place this fall on the boiler in Williamsport,PA, which is also the proposed site for the 1000 hour test.

The following organizations have sponsored the first 3 phases of the project:

Coal Tech Corp.

Southern California Edison,Penn.Power & Light,Philadelphia Electric,Houston Lighting & Power

A major oil company.

Ben Franklin Partnership Program of the State of Pennsylvania, which supports advanced technology development in the State.

Pennsylvania State University,

Pennsylvania Energy Development Authority which provides assistance for the development of the State coal resources in an environmentally acceptable manner;

For the DOE Clean Coal Project, Coal Tech has requested that the Department of Energy provide 50% of the cost of the proposed 1000 hour test project.The remaining cost will be provided by

the Pennsylvania Energy Development Authority,
the Southern California Edison Company,
the Pennsylvania Power & Light Company,
and Coal Tech

At the conclusion of this Program,we plan to market the combustor for the retrofit of existing industrial boilers from oil to coal, using off-site pulverization of coal or specialized low cost sources of finely ground coal waste, which has a high sulfur content. We estimate that such applications would be competitive with oil in the $10-15 dollar per barrel range.

At the same time,we propose to team with a utility to demonstrate the combustor at the utility size. Coal Tech has designed a 100 million BTU/hour combustor which is ready for fabrication. Depending on the environmental regulations in effect , the utility size combustor would find application to oil fired boiler retrofits or coal fired retrofits to meet emissions standards.

Based on our experience with the manufacturing cost of this combustor and its installation on the current 23 million BTU/hour boiler, we estimate that the use of this combustor on existing coal fired boilers ,assuming a 100 million BTU/hour modular size, would cost about $30-50/kw installed.

In addition, our experience to date with four widely different coals suggests that almost any US coal is suitable for this technology. Therefore, a potential market for this combustor could well exceed 10,000 units.

With regard to the DOE Clean Coal Program, I strongly support both the aims of the program and its emphasis on a joint effort by federal, state, and private sector participation. New technologies take a very long time to develop. At this time of low oil prices, we should take the opportunity to develop new coal technologies so that they are ready for the market place when future sharp increases in oil prices occur. However, irrespective of oil prices, I believe that coal technologies that are not capital intensive, such as retrofits of existing equipment, should have an economic advantage over new plants, and that is the reason for my enthusiasm for our combustor.

Thank you for inviting me to appear before the Committee, and I would be happy to answer any questions.

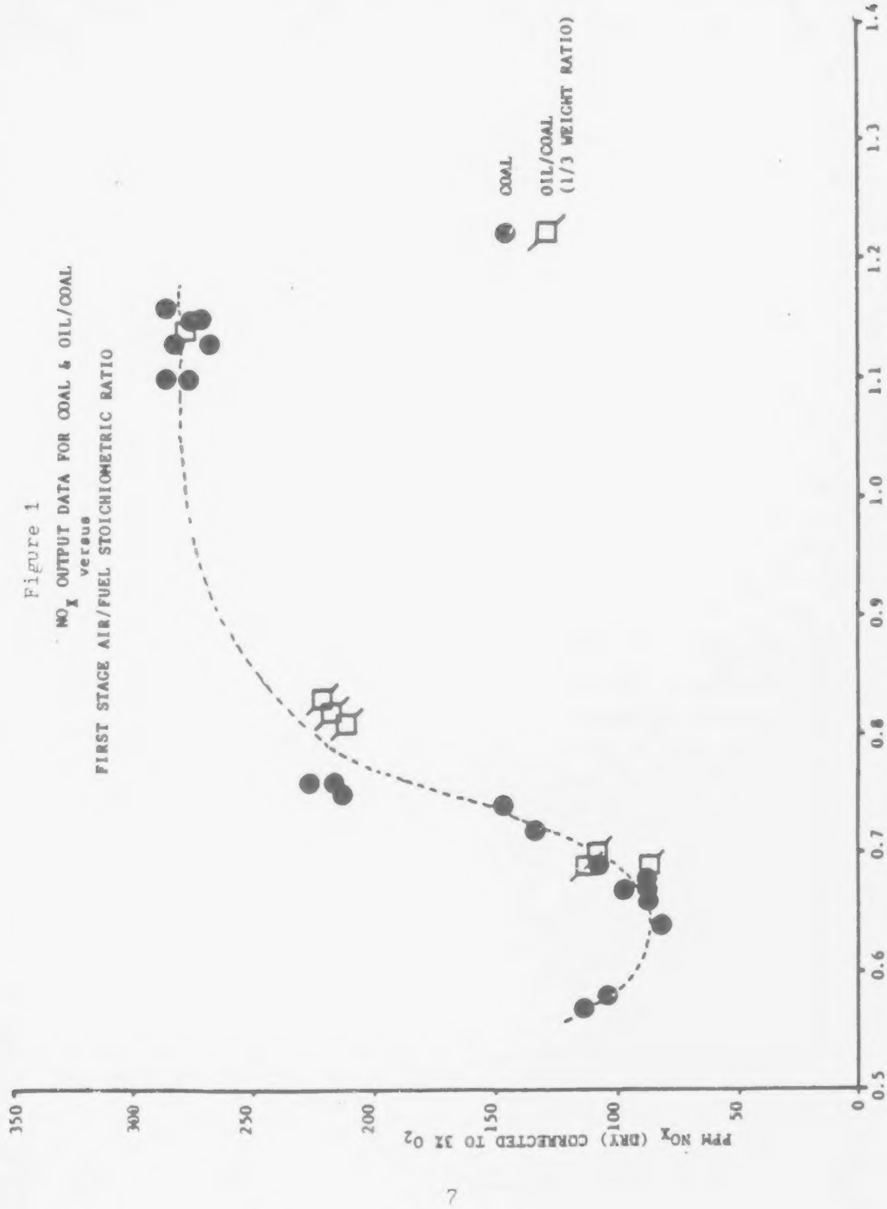


Figure 1

NO_x OUTPUT DATA FOR COAL & OIL/COAL versus FIRST STAGE AIR/FUEL STOICHIOMETRIC RATIO

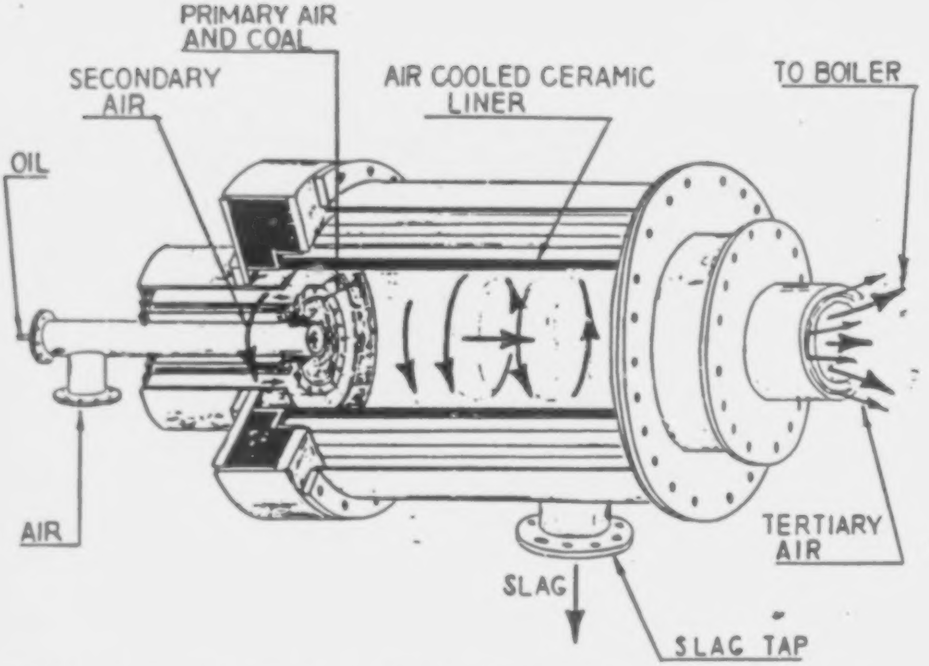
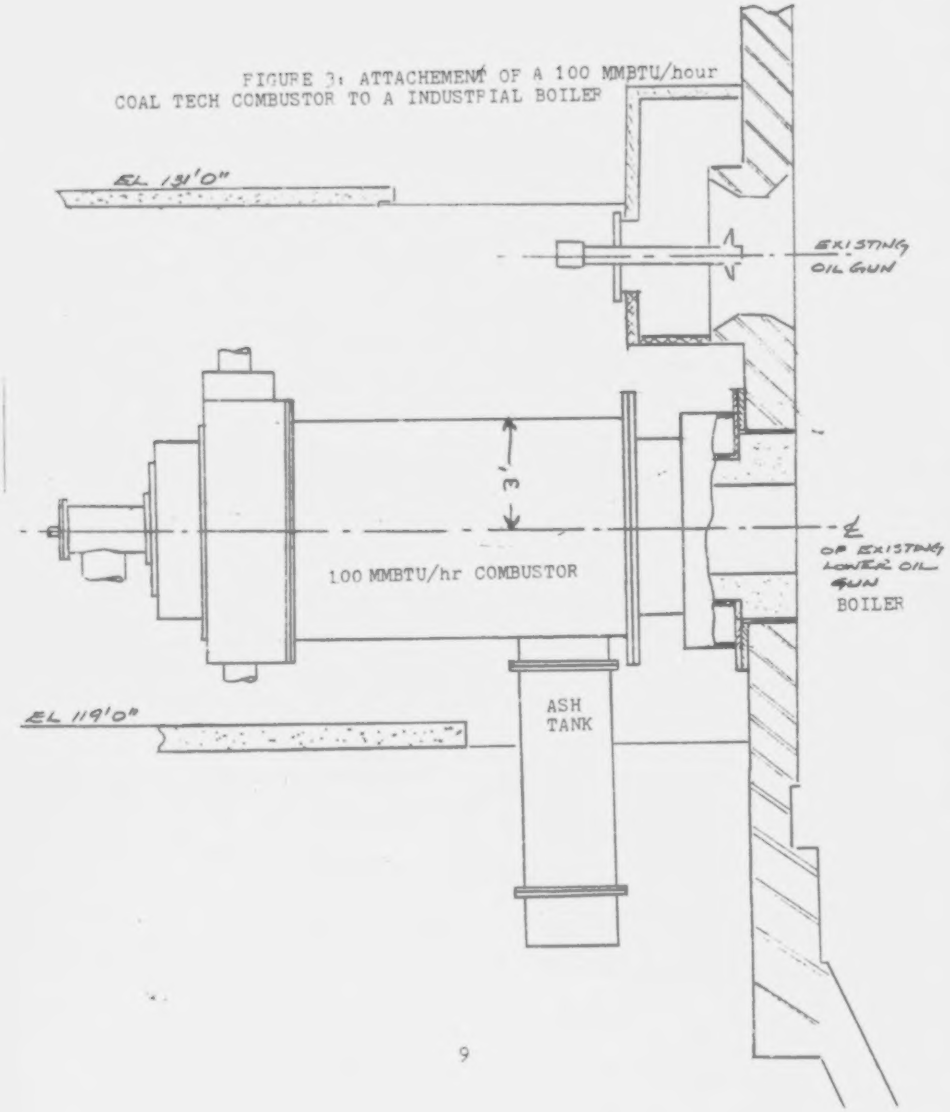

PRIMARY AIR
AND COAL
SECONDARY
AIR
AIR COOLED CERAMIC
LINER
TO BOILER
OIL
AIR
TERTIARY
AIR
SLAG
SLAG TAP

FIGURE 2 SCHEMATIC SKETCH OF COAL TECH'S AIR COOLED CYCLONE COMBUSTOR

FIGURE 3: ATTACHEMENT OF A 100 MMBTU/hour COAL TECH COMBUSTOR TO A INDUSTRIAL BOILER


EL 131'0"
EXISTING OIL GUN
3'
100 MMBTU/hr COMBUSTOR
℄ OF EXISTING LOWER OIL GUN
BOILER
EL 119'0"
ASH TANK

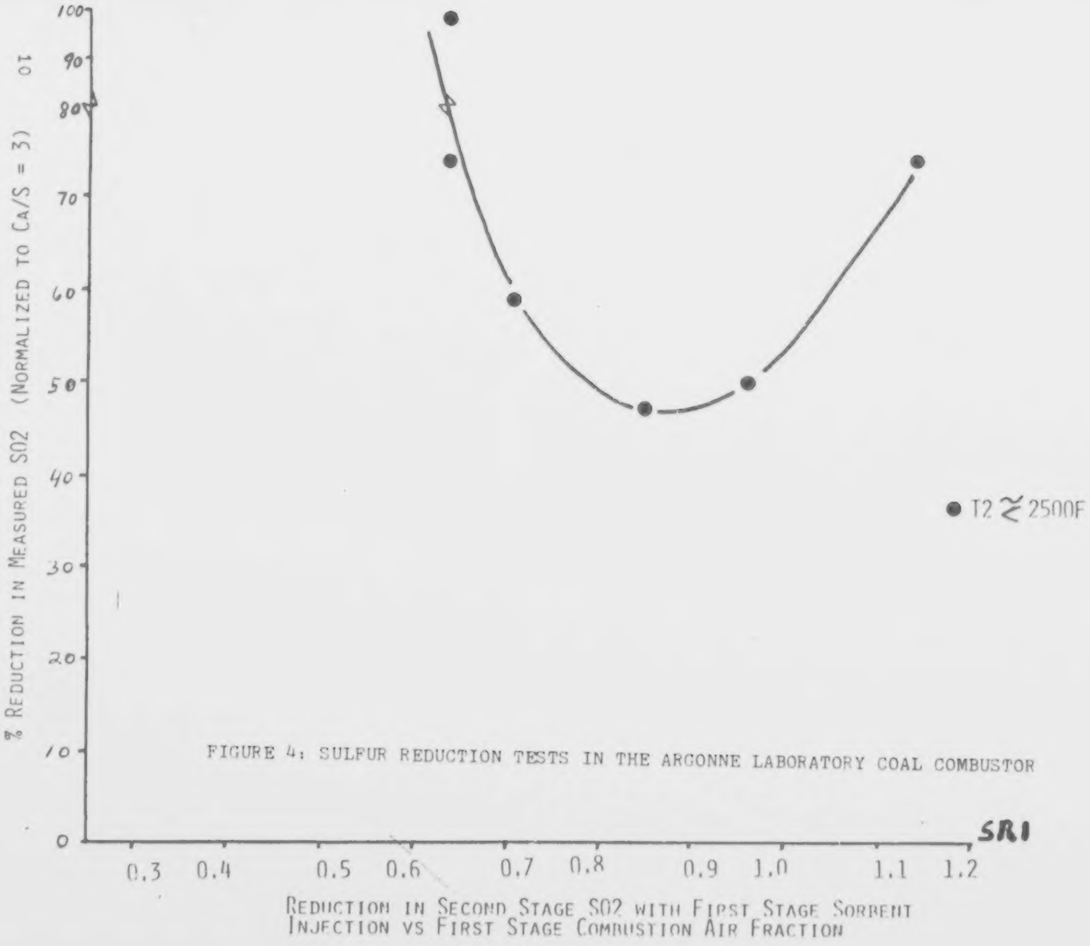


FIGURE 4: SULFUR REDUCTION TESTS IN THE ARGONNE LABORATORY COAL COMBUSTOR

Dr.BERT ZAUDERER

Dr.Zauderer is currently President of Coal Tech Corp.,which he founded in 1981 to perform R&D in coal combustion and energy technology and to develop an advanced cyclone coal combustor. Coal Tech has performed analytical and experimental studies in this field under partial sponsorship of federal and state R&D agencies,as well as private concerns in the energy industry.

In his prior position until 1981, he was Manager of Coal Technology and MHD Power Programs at the General Electric Company's Energy Systems Programs Department. Since joining GE in 1961, he held increasingly responsible positions in advanced power generation technology, with primary emphasis on MHD systems and coal technology.

Dr.Zauderer, received a Sc.D. degree from MIT in 1962. He is married, and the father of five children. He is a long time resident of Merion,PA.

COAL TECH CORP.
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Dr. Bert Zauderer
President

October 6,1986

The Honorable Don Fuqua,Chairman
Committee of Science and Technology
U.S.House of Representatives
Washington,DC 20515

Attention:Subcommittee of Energy Development and Application

Dear Mr: Chairman:

As a witness before the Subcommittee of Energy Development and Application on September 11,1986, I have edited and am returning the hearing transcript forwarded to me for review. I am returning the transcript, and I request that the following information be included in the hearing record:

Page	Line(s)	Proposed Wording
36	817-821	The data obtained to date by Coal Tech show that the sulfur reduction is independent of the sulfur content in the coal. Therefore, the same high sulfur reduction can be achieved in number 5 and 6 Ohio coals.
38	888-890	Retrofit of boilers with the Coal Tech combustor is simple. The combustor is attached externally to the wall of an existing boiler, generally at the existing burner opening, as is the case in the boiler to be used for the DOE Clean Coal Project.
39	899-903.	Below that range, it (the market) would depend on the source of coal. Coal grinding is a very large fuel cost factor in our technology, and ,therefore, finely ground coal waste from mine washing operations is an attractive fuel for this combustor, even if the waste has a high ash and sulfur content.
39	904-905	We could afford to pay $35/ton for the coal waste and still make a profit in converting a boiler from oil to coal.
40	923-929	The cost proposed by Coal Tech was based on meeting the minimum documentation requirements. DOE asked us to review our proposed documentation and adjust the cost, if necessary.
42	977-978	In connection with this, I wish to strongly endorse the the Small Business Innovation Research Program.

COAL TECH CORP.

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42	980	We have won several contracts from this (Small Business) program.
44	1022	Switching the oil is an alternative if the price of coal and the capitalized cost of any future required environmental cleanup equipment is greater than the cost of oil and the capitalized cost the equipment needed to switch from oil to coal. In my opinion, extensive switching to oil could occur if the price of oil were to remain below $10/barrel for a number of years.
42	1025	$50/barrel 'v the mid 1980's.
42	1026	A financial executive, in an interview in Barrons' in the summer of 1986, was quoted as predicting $5/barrel oil in the near future, and an extended period of low oil prices.
44	1028-1031	From extensive advanced power system analysis, I learned that since oil is a commodity with a variable price, one must minimize the capital equipment cost exposure in switching from one fuel to another. Therefore, capital cost recovery..
45	1044-1046	Other technologies that have a higher capital cost for fuel switching equipment would have longer payback periods, and their use would involve greater financial risk.

I understand that this letter may be inserted in the transcript in the form of an appendix and referred to by footnote in the main text.

Sincerely,

Dr.Bert Zauderer

Mr. **Walgren**. Let me just understand that last comment you made. You are concerned about the possibility of delay between phase III?

Dr. **Zauderer**. Which is underway right now.

Mr. **Walgren**. And that is the test, is that right?

Dr. **Zauderer**. That is a very short-duration test. Installation of the unit on the boiler that will be tested in the Clean Coal Program and shakeout tests, which are funded right now under other programs.

Mr. **Walgren**. I see. And that is not the 1,000-hour test?

Dr. **Zauderer**. No.

Mr. **Walgren**. That's what you're asking for from DOE, and that's what you want to have follow on.

Dr. **Zauderer**. Right away, yes.

Mr. **Walgren**. Without delay?

Dr. **Zauderer**. Yes.

Mr. **Walgren**. Well, thank you very much for that testimony.

Let's turn to Dr. Womack, and then we will come back for some discussion among all of us.

Dr. Womack.

STATEMENT OF DR. E.A. WOMACK, JR., VICE PRESIDENT, RESEARCH AND DEVELOPMENT AND CONTRACT RESEARCH DIVISION, BABCOCK & WILCOX CO.

Dr. **Womack**. Thank you, Mr. Chairman. Members of the subcommittee, I am Allen Womack, vice president for research and development and contract research of the Babcock & Wilcox Co. Needless to say, I appreciate the invitation to be here this morning and to talk about the LIMB Program.

"LIMB" stands for "limestone injection multistage burning," and I will attempt briefly to explain what that's all about. I would like to ask you to refer to an exhibit with some figures that should be in front of you, and this little graphic that I have to help me explain the project itself.

Mr. **Walgren**. If you would suspend for just a moment until we find—we don't seem to be able to put our hands on it.

Dr. **Womack**. Mr. Esleeck has some additional copies. Perhaps he can bring some up quickly.

Mr. **Walgren**. Could we have some for the members, at any rate?

Dr. **Womack**. You have, Mr. Dugan, in your hand the item to which I refer.

Inside this leaflet is a schematic, and that schematic is also reproduced on this little exhibit.

Obviously, the—excuse me, Mr. Chairman.

[Pause.]

Mr. **Walgren**. I wanted to make sure that—OK, thank you very much, and please continue.

Dr. **Womack**. The objective of the LIMB project is simultaneously to reduce the emissions from the coal-combustion process of oxides of nitrogen, or NO_x, and oxides of sulfur, or SO_x, in a concept which can be applied to existing coal-fired boilers as a retrofit.

The process, the basic LIMB process, involves two technologies. The first, for the reduction of NO_x, involves replacing the burners in the burner zone of a boiler, with specially designed burners whose effect is to control the combustion (reduce the average combustion temperature), and limit the rate at which the nitrogen and oxygen present in the air (combustion air), combines and thereby obtain approximately a 50-percent, for this particular boiler, reduction in the NO_x emissions estimated in that range.

The second technology in basic LIMB, which is the limestone injection part, involves injecting in the upper portion of the boiler itself a dry powdered sorbent, which can be a lime-containing compound, limestone or calcined lime.

This sorbent, the calcium present in this sorbent combines chemically with the oxides of sulfur created in the burning of the coal. They are thereby captured in a dry form, which can then be—which can then be picked up in the particulate collection equipment, the electrostatic precipitator at the back of the boiler, and removed as particulate matter. That process is expected to result in a reduction in sulfur oxide emissions in the range of 50 to 60 percent. Various approaches to enhancing that process are being studied, including controlling the humidity in the back pass of the boiler.

The basic LIMB project was begun in 1984 by a Government and industry consortium consisting of the U.S. Environmental Protection Agency, the State of Ohio, the B&W Co., and Ohio Edison. The basic concept of the project was to undertake a full-scale demonstration on a 104-megawatt boiler belonging to Ohio Edison and located in Lorain, OH, on Lake Erie. The picture on the front of the exhibit shows an air view of this plant.

Preliminary laboratory tests have been done, and the design work is proceeding rapidly. In fact, we have begun construction of the necessary modification for the first phase of LIMB, which will install the limestone injection and low-NO_x burners.

The project which the LIMB group has proposed to the Department of Energy is an extension of this baseline project, which does two important things: It allows us to complete this demonstration with additional coals and sorbents, which is very important ultimately for assessing the costs and difficulty of deployment of this project to the large base of installed, coal-fired boilers which could be candidates to use this technology.

And, second, the extension provides for a demonstration of another, third technology we call coolside, developed by Consolidation Coal Co.'s research laboratories, and which may enhance the sulfur collection of the process to the 70-percent-and-greater range. The coolside technology involves injecting additional sorbent material and humidification in the flue ducts of the boiler—shown here and shown also in your schematic.

The DOE extension of the project will be a two-phased, $21 million, 34-month program. The total project, including both phases, is about a $47 million project. The extension costs from the DOE is about—the DOE is being requested to supply about 36 percent of the extension costs and about 17 percent of the total project.

In the back phase, in the extension of the project, Consolidation Coal and Dravo Co. will join the other sponsors, along with DOE.

The project as a whole is a balanced sponsored project with about one-third Federal money, one-third State of Ohio money, and one-third industrial partners' or consortium members' money.

The applicability of these technologies is quite broad. This boiler is representative of a large percentage of the installed capacity in the United States. Low-NO_x burners of this sort could be installed in a very substantial percentage of burners, and the limestone injection process, with development, and the coolside process is potentially applicable to an even larger installed base of the boilers. So this is a retrofit technology with broad application.

We will, through this project, as I have said, demonstrate all three technologies. The first set of modifications will be demonstrated next year at Lorain. Following that, the modifications for the coolside process will be done. And those demonstrations should occur in 1988–89, with the project wrapup presently targeted to be complete around early 1990.

The LIMB sponsors are pleased to have been selected to be a part of the Federal Clean Coal Technology Program. We support the objectives of the program, and we believe in the promise of this technology as a means to help reach them.

You asked us, in preparing for this testimony, to comment on the second phase, potential second-phase program, and I would like to speak for myself to say that I believe that in economically reducing emissions from powerplants, we have such a diversity of plants in the installed base that we are going to need to tailor individual technologies such as these to the individual powerplants. And it is important—this program is very important. I think the program extension could further provide opportunities for additional technologies to be demonstrated, and we would urge the committee to consider emphasizing in that extension retrofittable technologies such as this or repowering technologies.

And finally, I would like just to say again that we appreciate the vision and the encouragement that this committee has offered to stimulate and support clean coal technology, and I would be happy to respond to your questions to the best of my ability.

[The prepared statement of Dr. Womack follows:]

HEARING BEFORE THE
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WRITTEN STATEMENT OF
ALLEN WOMACK
VICE PRESIDENT
THE BABCOCK & WILCOX COMPANY
SEPTEMBER 11, 1986

Mr. Chairman, Members of the Subcommittee, I am Allen Womack, Vice President for the Research & Development and Contract Research Divisions of the Babcock & Wilcox Company. I appreciate this invitation to meet with you to discuss the Department of Energy's Clean Coal Technology program and, in particular, B&W's proposal for demonstrating Limestone Injection Multistage Burner, known as LIMB. We are pleased that our LIMB program was one of the nine Clean Coal Technology proposals selected by DOE for contract award, subject to final negotiations.

Coal is America's most abundant fossil fuel resource. Much of this natural wealth occurs mixed with sulfur and nitrogen compounds. When this coal is burned, the sulfur and the nitrogen are oxidized along with the coal's carbon. Like the oxide of carbon, the oxides of sulfur and nitrogen are gases at normal temperatures. Unless special measures are taken, these gases escape into the atmosphere. Additional oxides of nitrogen are formed during the combustion process of any fuel because the high temperatures of burning cause a certain amount of atmospheric nitrogen to combine with atmospheric oxygen.

Reducing these SO_2 and NOx emissions from the coal combustion process is the objective of Clean Coal Technology. As you can imagine from the foregoing description, there are a variety of ways in which this might be done. Chemical and physical processes can be used to remove sulfur and nitrogen from the coal before combustion. After combustion the gases from the burning process can be "scrubbed" to remove the oxides of sulfur. The only fully commercially available and proven process for removing oxides of sulfur today is of this latter sort. Machines which extract the sulfur dioxide from the combustion gas (or flue gas) are called scrubbers. Basically they are large vessels which provide physical contact between the flue gas and a liquid or slurry of an alkali-metal compound (usually lime or limestone). A chemical reaction takes place between the calcium of the slurry and the sulfur dioxide in the flue gas which binds the sulfur to the calcium producing a sludge which can be removed for disposal. These "wet scrubbers" are effective but quite expensive. The large quantity of equipment necessary represents a large capital investment, and the devices are complicated and expensive to operate. All this ultimately increases the cost of the power generated, making electricity more expensive and America less competitive.

At the present, most of the coal burning electrical power plants in the United States do not have wet scrubber equipment. It is in the national interest to find ways to reduce the SOx and NOx emissions from these power plants without installing this expensive equipment. This is the objective of the Clean Coal Technology Development Programs.

We believe that no single technology will provide the most effective and economic solution to our desire for clean air, inexpensive energy, and effective utilization of our great natural resources. The power plants which energize our country today, and the coals that they burn, have many differences among them. Some of the clean coal technologies will be more effective for certain power plants and regions than others. It is important therefore to have diversity in our development programs both in order to increase the certainty of overall success and to provide a family of solutions which can be economically tailored to the needs of individual plants.

Babcock & Wilcox and its associates in the LIMB project believe that LIMB can be an important option. The LIMB concept is designed to reduce the emissions of both SO_2 and NOx from existing power plants which burn pulverized coal as a fuel, and which are already fitted with particulate collection equipment (such as electrostatic precipitators). Thus it has broad potential applicability to U.S. coal-fired boilers. The basic sulfur dioxide capture concept is similar to the wet scrubbers I described previously: an alkali-metal containing sorbent is brought into contact with the combustion gases so that the SO_2 can be converted into an easily collectible solid compound. The difference is that with LIMB this process occurs in the dry state in the existing furnace of the power plant boiler rather than in new equipment added to the plant. By eliminating the need for building large scrubber tanks and special facilities, the capital cost of the LIMB concept is substantially reduced. Although the expected sulfur collection efficiency is lower than the best scrubbers, LIMB should be effective at removing approximately 50% of the SO_2 and at a very much lower cost. In LIMB we combine this sulfur collection concept with replacement of the coal burners in the firing region of the furnace to produce lower overall generation of oxides of nitrogen.

This is accomplished by decreasing the temperature at which the combustion occurs and reducing the formation of NOx from the combination of atmospheric nitrogen and atmospheric oxygen. The net reduction of NOx production should also be in the 50% range.

The attached color information sheet contains a diagram which illustrates how these processes can be applied to an existing boiler. Equipment is added to the upper furnace to inject the sorbent. The combination of sorbent and sulfur occurs right in the furnace chamber. The resulting solids are collected in the existing precipitator and carried off along with the ash. Multistage burners are installed in place of the plant's existing burners to reduce the NOx. Plant operation is affected only slightly, but emissions undergo a substantial reduction.

In 1984 a government and industry consortium consisting of the United States Environmental Protection Agency, the State of Ohio, the Babcock & Wilcox Company, and Ohio Edison Company undertook to conduct a full scale demonstration of this concept on an existing coal-fired boiler in northern Ohio. Preliminary laboratory work has been done and design work is rapidly being completed for the first demonstration tests. In fact, construction of the necessary modifications to the boiler has already begun. During the early phases of this project, its promise appeared sufficient to recommend innovations which have potential for enhancing its effectiveness. A second phase, which will enhance the particulate collection efficiency and the sulfur collection efficiency as well, has recently been planned as an extension of the original demonstration project. Selection of the LIMB project to participate in the Department of Energy's Clean Coal Technology Program will enable us to extend the originally planned demonstration to cover a broader range of coals and sorbents in the testing which should substantially increase the usefulness of the results in subsequent application of the concept to other boilers. In this phase of the project, Consolidation Coal (CONSOL) and Dravo Company will join the other sponsors. This extension will permit us to demonstrate a third technology, called "Coolside" which adds further sorbent injection in a controlled temperature region of the flue gas ducting after the boiler. It is expected that this addition will increase the total sulfur reduction capabilities of the system, thus expanding the range of application for the technology.

The proposed DOE extension will be a two-phased/21 million dollar/34 month program. The project team is requesting approximately 36 percent of the extension cost from the DOE, which is less than 17 percent of the remaining total program value.

The full project as it is now conceived is believed to be the most extensive and complete of its kind. Three technologies will be demonstrated: in-furnace sorbent injection for SO_2 reduction; in-furnace NOx reduction with multistage burners; and "Coolside" for enhanced SO_2 removal and precipitator performance. In addition, a variety of coals and sorbents will be tested.

As I have mentioned, the first set of modifications has already begun at Ohio Edison's Edgewater Station. Modifications and testing for the various phases of the project will continue for the next four years. During this period of time, we should be able to demonstrate both the technical concepts and the economic feasibility of the LIMB approach and provide a thorough evaluation of its usefulness as a retrofit clean coal technology.

The LIMB sponsors are pleased to have been selected to be a part of the Federal Clean-Coal Technology Program. We support the objectives of this program, and believe in the promise of the LIMB technology as a means to help reach them.

Others who have spoken to you this morning have discussed the current hiatus in new plant construction in the electrical power industry. Most of our utilities today are concentrating on completing plants designed some time ago and on extending the useful life of older plants. These already completed plants represent a major national investment. It is therefore extremely important that the Clean Coal Program concentrate especially on technologies which can be applied economically to already completed plants, the so called retrofit technologies. As I have already pointed out, LIMB is an example of such a technology. Several others of the DOE selected projects also represent approaches which can be applied to conserve existing sites and equipment, including the American Electric Power's pressurized fluid bed combustion repowering of their Tidd Station. In looking forward to the second phase of the

Clean Coal Program, I would respectfully urge the Committee to emphasize the importance of developing additional technologies which can be applied economically to existing power plants. I believe that moving ahead with this emphasis would continue the momentum in clean coal technology and provide a basis for early commercial use of the developments. B&W looks forward to participating with you.

I would like to close by expressing once more my appreciation for the vision and encouragement you have offered by your stimulation and support of Clean Coal Technology, and to offer to respond to your questions.

Limestone Injection Multistage Burner (LIMB)

New utility system to demonstrate reductions in emissions linked to acid rain

LIMB (shorthand for limestone injection multistage burner) is a new pollutant-control technology that aims to help utilities lower sulfur dioxide and nitrogen oxide emissions from existing power plants by turning portions of the gases from a coal-burning boiler into easily disposable solids.

This combination of new, advanced technologies will primarily be applied to existing coal-fired utility boilers to reduce emissions that some have linked to causes of acid rain.

A multimillion dollar project, cosponsored by government agencies as well as utility and industrial firms, is being carried out to demonstrate the capability of LIMB technology to remove sulfur dioxide (SO_2) and to reduce nitrogen oxides (NO_x) generated at an existing power plant in northern Ohio. Activities to design, construct, operate, and evaluate the system in the full-scale, coal-fired utility boiler are underway and taking shape.

In the LIMB process, reduced sulfur dioxide emissions will result from the injection of a sorbent material (an absorbing medium derived from limestone) into the boiler while the coal is burning. This technique differs from the use of scrubbers, which remove SO_2 from combustion gases in large and costly chemical process equipment. Lower NO_x levels are achieved through installing new burners that decrease the volume of excess air in the combustion zone.

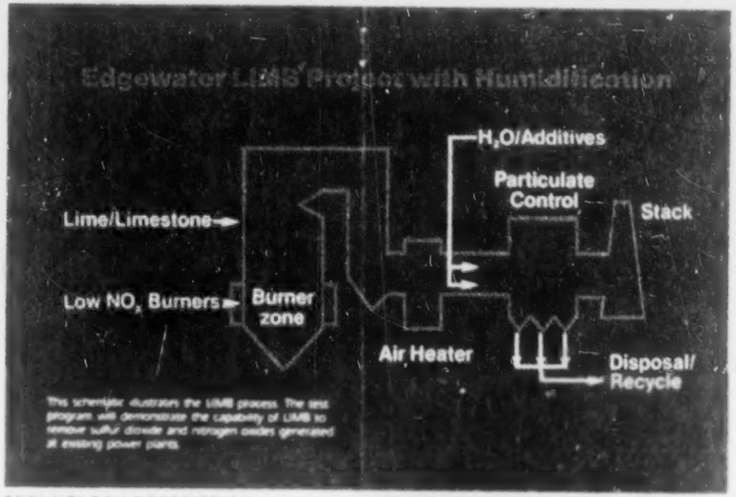
The 104-megawatt boiler at Ohio Edison's Edgewater plant in Lorain, Ohio, has been chosen as the site for the LIMB demonstration.

ANTICIPATED BENEFITS

[illegible]

PROJECT SPONSORS

[illegible]



Edgewater LIMB Project with Humidification
Lime/Limestone
Low NO$_x$ Burners
Burner zone
Air Heater
H$_2$O/Additives
Particulate Control
Stack
Disposal/ Recycle

This schematic illustrates the LIMB process. The test program will demonstrate the capability of LIMB to remove sulfur dioxide and nitrogen oxides generated at existing power plants.

TECHNOLOGY DESCRIPTION

[illegible]

[illegible]

Design Issues

The primary issues addressed in the LIMB demonstration program are:

- Refining fundamental understanding of the process chemistry.
- Selecting efficient and economical sorbents.
- Designing an optimal sorbent-injection/handling system.
- Developing an acceptable waste-handling/disposal system.
- Selecting low-NO_x burners that can be accommodated by the existing power plant.
- Developing a flue gas humidification system.

PROJECT STATUS

Started in 1984, the LIMB demonstration project is scheduled to run through 1988. Extensions are expected to require additional work into 1990. Detailed engineering design began in early 1986. Construction is scheduled to start during the fall of 1986. Testing will be initiated in mid 1987.

Project Extensions

Extensions of the basic LIMB demonstration project are designed to demonstrate an associated technology (Coolside Sorbent Injection) that is also expected to be low in capital cost and low in costs for particulate and SO_2 capture. The extensions will test other available coals and sorbents that enhance the demonstration of the LIMB process as a retrofittable technology.

COMMERCIALIZATION

The degree of commercial interest in LIMB would be related to any legislation that might govern environmental controls, price variance between high and low sulfur coals, and the need to reduce the emissions from existing coal-fired boilers. Based on the current status of LIMB development, B&W projects 1990 as the most optimistic time for commercialization of this promising retrofit technology.

For more information on LIMB, contact one of the following:

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Mr. **Walgren**. Thank you very much, Dr. Womack.

Let's turn to Dr. Heap.

STATEMENT OF DR. MICHAEL P. HEAP, ENERGY & ENVIRONMENTAL RESEARCH CORP.

Dr. **Heap**. Thank you, Mr. Chairman. I appreciate the opportunity to submit testimony today that summarizes the proposal submitted by EER in response to the Department of Energy's Program Opportunity Notice for Clean Coal Technology Projects. The proposal is entitled "Enhancing the Use of Eastern and Midwestern Coals by Gas Reburning-Sorbent Injection." I would like to provide a summary of the proposed project and describe the cofunding arrangements.

The cost of power generation from existing pulverized coal-fired steam generating plants——

Mr. **Walgren**. Pardon me. Let me ask you to pull that mike a little bit closer so it projects to the back of the room.

Dr. **Heap**. Better?

Mr. **Walgren**. Even closer. OK, that's going to work.

Dr. **Heap**. The cost of power generation from existing pulverized coal-fired steam generating plants is strongly dependent upon coal quality and requirements for environmental controls. Coal contains impurities which can cause operational problems due to slagging, fouling, erosion, and corrosion. All of these affect the availability and maintainability of the plants and consequently the cost of power. Many of the impurities found in coal are converted to atmospheric pollutants during combustion. Mineral matter forms flyash, sulfur is oxidized to sulfur dioxide, and some of the organically bound nitrogen is converted to nitric oxide.

Acid precipitation in certain parts of the United States and Canada has been attributed to the emission of sulfur dioxide and nitric oxide from coal-fired powerplants. Proposed legislation to reduce the emission of these pollutants, considered to be acid rain precursors, will most probably increase the cost of power due to the addition of air-pollution control devices and increase the use of low-sulfur coals, thereby reducing the demand for eastern and midwestern coals.

Consequently, there is a need for a low-cost, retrofit, acid rain precursor control technology which will provide the utility industry with the potential to use local coals and produce power at the least cost while maintaining environmental standards. Gas reburning/sorbent injection is one such technology.

Gas reburning/sorbent injection is an integration of two developmental technologies: Reburning for NO_x control and sorbent injection for SO_x control. It is a low-cost retrofit technology with an application to all types of coal-fired boilers. Gas reburning involves the injection of natural gas above the main heat release zone to reduce the nitric oxide formed in that zone to molecular nitrogen.

Low-cost calcium-based sorbents can be injected at several locations, thereby reducing sulfur dioxide emissions. In addition, humidification can be used to obtain additional sulfur capture.

Pilot scale data obtained by EER illustrates the potential for gas reburning/sorbent injection for combined NO_x/SO_x control. These data indicate that 60 percent NO_x reductions can be achieved from typical NSPS NO_x levels. Sulfur dioxide reductions in excess of 50 percent can be achieved by combining reburning with sorbent injection if a hydrated sorbent is used.

The benefits of the technology include: NO_x emissions are reduced by 60 percent. This can be achieved without the need for modifications to the original firing equipment, eliminating problems associated with retrofitting low-NO_x burners. Gas is ideal as a reburning fuel because it can be distributed evenly, it is more effective in reducing NO_x than coal and requires less residence time in the reburning zone.

Second, SO_x emissions are reduced by a minimum of 50 percent, dependent upon the sorbent injection rates, and the sorbent injection requirements to provide a given reduction in SO_2 emission are reduced in direct proportion to the amount of gas cofiring. This reduces the load on a particular control device, a key factor in the application of sorbent injection.

Gas reburning can be applied in conjunction with various sorbent injection technologies as well as coal cleaning. Gas reburning/sorbent injection has the potential to improve the operability of some pulverized coal-fired boilers, and it can be retrofitted to pre-NSPS wall-, corner-, and cyclone-fired units.

EER proposes to conduct a program at three host utility sites to demonstrate the technical feasibility and cost effectiveness of the technology, and Phase 1 will culminate in the detailed design of a gas reburning/sorbent injection system at each of three host sites. An industry panel will be established to initiate technology transfer and encourage commercialization of the technology.

Phase 2, construction and startup. Following approval, the gas reburning and sorbent injection equipment will be installed and checked out at each host site.

Phase 3, operation, data collection, reporting, and disposition. Each host unit will be tested over a range of conditions with several U.S. coals, culminating in a 1-year long-term evaluation of the technology.

The program will conclude with the preparation of a design guideline manual.

The objective of this project is to provide a comprehensive data base, demonstrating the applicability of gas reburning sorbent injection when applied to pre-NSPS utility boilers, and to promote the commercialization of the technology.

Since the design and operating characteristics of pre-NSPS utility boilers vary widely, no single demonstration will be adequate. Consequently, EER proposed to conduct a total of three demonstrations, using three NSPS utility boilers with widely varying characteristics. The GR-SI systems will be designed for optimum performance as applied to each specific host unit.

The schedule proposed for this program is one that allows for rapid commercialization of the technology. As proposed, the program will be completed in 4 years.

Commercialization of gas reburning/sorbent injection, once its performance has been verified, is possible because the infrastructure is already in place to apply the technology. Architect and engineering firms, boiler manufacturers, and utilities will be in a position to commercialize the technology, and this program will provide the technical base for application of gas reburning/sorbent injection.

Commercialization will depend upon the supply and price of natural gas, and as a result of the recent decline in gas prices and the large gas resource base, the attractiveness of using gas in combination with coal to meet more stringent environmental standards is enhanced. These declining gas prices appear to be not only the result of falling oil prices, but also to a continuing surplus of gas deliverability, intense gas-to-gas competition, and increased use of negotiated gas carriage. Therefore, gas reburning/sorbent injection represents a near-term cost-effective solution to the environmental problems which result in coal combustion.

The estimated total cost of the program proposed by EER is $30 million. Two organizations have committed to provide cofunding for the program. The Gas Research Institute will provide $10 million, and the Department of Energy and Natural Resources of the State of Illinois will cofund $5 million. In addition, EER, which is a small business, with its headquarters in California and offices in Ohio, New Jersey, and North Carolina, will provide certain equipment and facilities for use on the program at no cost.

Three host sites in the State of Illinois have agreed to participate in the program, contingent upon the negotiation of a satisfactory host agreement once all the terms and conditions of the DOE contract are known. The Electric Power Research Institute has expressed interest in the program, as have several gas companies.

In conclusion, this demonstration program of gas reburning/sorbent injection already has the financial support of two organizations and the interest of the utility industry. A successful demonstration of the technology will lead to the commercialization of a cost-effective near-term acid rain precursor control technology which will encourage the use of local coals and provide the utility industry with the flexibility to meet pollutant emission regulations with the fuel of choice at the least cost to the consumer.

Thank you very much, Mr. Chairman.

[The prepared statement of Dr. Heap follows:]

Testimony of Michael P. Heap
Executive Vice President, Energy and Environmental Research Corporation
Before the U.S. House of Representatives Committee on
Science and Technology
September 11, 1986

I appreciate the opportunity to submit testimony today that summarizes a proposal submitted by the Energy and Environmental Research Corporation (EER) in response to the Department of Energy's Program Opportunity Notice for Clean Coal Technology Projects (PON Number DE-PS01-86FE60966). The proposal entitled "Enhancing the Use of Eastern and Midwestern Coals By Gas Reburning - Sorbent Injection" was selected for negotiation and I would like to provide a summary of the proposed project and describe the co-funding arrangements.

Gas Reburning - Sorbent Injection

The cost of power generation from existing pulverized coal fired steam generating plants is strongly dependent upon coal quality and the requirements for environmental controls. Coal is not a pure hydrocarbon, it contains mineral matter, sulfur, nitrogen etc. These impurities can cause operational problems due to slagging, fouling, erosion and corrosion which affect the availability and maintainability of the plant and consequently the cost of power. Many of the impurities found in coal are converted to atmospheric pollutants during combustion. Mineral matter forms fly ash, sulfur is oxidized to sulfur dioxide and some of the organically bound nitrogen is converted to nitric oxide. Acid precipitation in certain parts of the United States and Canada has been attributed to emissions of sulfur dioxide and nitric oxide from coal fired power plants. Proposed legislation to reduce the emission of these pollutants considered to be "acid rain" precursors will:

1. Increase the cost of power due to the addition of air pollution control devices

2. Increase the use of low sulfur coals thereby reducing the demand for Eastern and Midwestern coals.

Consequently there is a need for a low cost acid retrofit rain precursor control technology which will provide the utility industry with the feasibility to use local coals. Gas reburning - sorbent injection is one such technology.

Gas Reburning - Sorbent Injection (GR-SI) is an integration of two developmental technologies: reburning for NO_x control in conjunction with sorbent injection for SO_x control. GR-SI is a retrofit technology with application to all types of coal fired boilers. A schematic showing the application of GR-SI to a corner fired boiler is illustrated in Figure 1. Gas reburning involves the injection of natural gas above the main heat release zone to reduce the nitric oxide formed in the main heat release zone to molecular nitrogen. Low cost calcium based sorbents can be injected at one or more locations as the combustion gases pass from the radiant furnace, through the convective passes to the air heater.

The concept of reburning for NO_x control has been recognized for over a decade. The original laboratory scale work was carried out in the U.S. but recently the Japanese have applied the concept to boilers. The process can be described by considering that the furnace is divided into three regions:

1. Main Heat Release Zone: Approximately 85 percent of the heat is released in this zone under fuel lean conditions producing nitric oxide together with products of combustion which form the input to the reburning zone. In addition, if sufficient residence time is not provided in the main heat release zone, unburned fuel fragments may leave this zone and enter the reburning zone.

2. Reburning Zone: The gas reburning fuel (normally 10 to 20 percent of the total fuel input to the boiler) is injected downstream of the primary zone to create a fuel rich, NO_x reduction zone. Nitric oxide formed in the main heat release zone reacts with the

hydrocarbon fragments formed during the oxidation of the reburning fuel, primarily CH species, to produce intermediate species such as HCN and NH_3 and N_2.

3. Burnout Zone: In the third and final zone air is added to produce overall lean conditions and oxidize all remaining fuel fragments. The remaining total fixed nitrogen species (NH_3 + HCN + NO) will either be oxidized to NO or reduced to molecular nitrogen.

The major process parameters which control the efficiency of the reburning process are the stoichiometry, temperature and residence time of the reburning zone.

The injection of calcium based sorbents for in-furnace SO_2 control has been the subject of much research effort over the last twenty years because of a desire to develop an alternative to flue gas desulfurization. Full scale demonstrations carried out by TVA in the early 1970's gave rather poor results. Recent experience in Germany and research funded by DOE and EPA suggest that significantly higher SO_2 capture levels can be achieved by injecting the sorbent at the most appropriate location in the furnace which is dependent upon the temperature and flow field in each application.

Upper furnace injection (see Figure 1) involves the injection of calcium carbonate or calcium hydroxide at an appropriate temperature, approximately 2250°F. The sorbent calcines and subsequently reacts with sulfur dioxide to produce a solid calcium sulfate which can be removed together with the fly ash in the particulate control device. Recent studies have indicated that injection at lower temperatures may also allow sulfur capture. GR-SI will use the most appropriate sorbent injection location dependent upon system constraints to achieve the maximum sulfur capture.

Figure 2 summarizes pilot scale data obtained by EER which illustrate the potential of GR-SI for combined NO_x/SO_x control. These data indicate that 60 percent NO_x reductions can be achieved from typical pre-NSPS NO_x levels. Sulfur dioxide reductions in excess of 50 percent can be achieved by combining reburning with sorbent injection if a hydrated sorbent is used. These data are typical of those obtained with optimized gas reburning/sorbent injection for a wide spectrum of primary fuels and they appear to be generally achievable in full scale system.

The benefits of GR-SI can be summarized by:

1. NO_x emissions are reduced by 60 percent. This can be achieved without the need for modifications to the original firing equipment eliminating problems associated with retrofitting low NO_x burners. Gas is ideal as a reburning fuel because it can be distributed evenly, it is more effective in reducing NO_x than coal and requires less residence time in the reburning zone.

2. SO_x emissions are reduced by 50 percent and because the two technologies are combined the burnout air can be used as a sorbent transport medium.

3. The sorbent requirements to provide a given reduction in SO_2 emissions are reduced in direct proportion to the amount of gas co-firing. This reduces the load on the particulate control devices.

4. Gas Reburning can be applied in conjunction with various sorbent injection technologies such as in-furnace or duct injection as well as coal cleaning.

5. GR-SI Provides the utility with flexibility in coal selection to meet acid rain control legislation.

6. GR-SI has the potential to improve the operability of some pulverized coal fired boilers.

7. It can be retrofit to pre-NSPS wall, corner and cyclone fired boilers. These units produce 12 million tons of SO_2 per year.

An Overview of the Proposed Demonstration Program

EER proposes to conduct a program at three host utility sites to demonstrate the technical feasibility and cost effectiveness of GR-SI in three phases as follows:

- Phase 1 - Design and Permitting. This initial phase will culminate in the detailed design of gas reburning and sorbent injection systems for each of three host sites. A program plan will be prepared for the equipment construction and demonstration testing. An industry panel will be established to initiate technology transfer.

- Phase 2 - Construction and Startup. Following approval, the gas reburning and sorbent injection equipment will be installed and checked out at each host site. The process and engineering designs will be presented to the industry panel.

- Phase 3 - Operation, Data Collection, Reporting and Disposition. Each host unit will be tested over a range of conditions with several U.S. coals culminating in a one year long-term evaluation. All data and test results will be compiled into a guideline manual which will be made available to industry. The project results will be presented to the industry panel.

The demonstration of GR-SI is not intended as a first generation of specific technology but rather it will build upon the results of several individual technology demonstrations now being conducted by the EPA and others. The focus of this program is to demonstrate the application and performance of a combined technology which will allow cost effective control of acid rain precursors. A major feature of the program is that GR-SI will be demonstrated on all three types of coal fired boilers which are typical of pre-NSPS designs (i.e. wall- corner- and cyclone-fired).

EER's technical approach is illustrated schematically in Figure 3. Each host site will be considered separately based on its unique design parameters, operating history and performance requirements. These factors will be evaluated by reviewing historical operating and performance data and plant design specifications. A field test will be conducted to quantify performance and emissions over the normal duty cycle. EER will consider several alternate and complimentary technologies: gas reburning for NO_x control, a range of approaches to sorbent injection for SO_2 control and coal cleaning. EER will select a technology combination for each site which meets the emissions control and performance objectives at minimum total cost. This process definition will include specification of all major components and projection of performance for each host site. Following DOE approval, EER will proceed with the detailed design. This will include complete construction plans including drawings, equipment specifications, cost estimates and construction schedules. All necessary permits will be obtained. Phase 1 will culminate in the preparation of a comprehensive program plan. It will detail the design and performance projections for the equipment to be installed at each of the three host sites, present construction plans and propose a demonstration plan for quantifying the performance at each host site.

Once DOE approval has been given the GR-SI hardware will be installed and checked out prior to the initiation of the technology demonstration in Phase 3. The demonstration will include:

1. Optimization testing to determine the conditions which provide the best overall balance of performance.

2. Evaluation of alternate coals and sorbents to extend the data base on the technology. The tests will include the use of a cleaned coal.

3. Long term evaluation of the GR-SI technology to assess impacts on boiler efficiency, slagging/fouling, carbon loss, convective pass erosion, auxiliary power consumption, precipitator performance and

ash disposal requirements as well as other site specific factors. The economic consequences will be evaluated according to the EPRI Technology Guide (TAG) procedures. Both the technical and economic performance will be considered in the overall evaluation of the optimum process design.

The program will conclude with the preparation of a Design Guideline Manual which will include the following elements.

1. Documented performance of the technologies demonstrated during the program. This will include the ability to meet the emissions and performance goals at each host site at minimum total costs.

2. Factors to be considered in applying the technology to pre-NSPS utility boilers.

3. Factors influencing performance of GR-SI including specific design parameters, coal and sorbent characteristics.

4. Economics of the technology including comparisons with alternate competing technologies.

5. Specific design guidelines for application of the technology including procedures for optimization of process parameters based on site specific conditions and design guidelines for key components.

The objective of this project is to provide a comprehensive data base demonstrating the applicability of GR-SI when applied to pre-NSPS utility boilers and to promote commercialization. Since the design and operating characteristics of pre-NSPS utility boilers vary widely, no single demonstration will be adequate. Consequently, EER proposed to conduct a total of three demonstrations using three pre-NSPS utility boilers with widely varying characteristics. The GR-SI systems will be specifically designed for optimum performance as applied to each specific host unit.

Table 1 summarizes the characteristics of each unit and presents the preliminary approach to optimization of the GR-SI technology. The three host sites are small utility boilers now in commercial operation in the State of Illinois. All fire Midwest bituminous coals and are equipped with cold side electrostatic precipitators for particulate emission control. These units differ in several significant respects:

- Firing configuration and capacity
- Electrostatic precipitator size
- Fuel characteristics
- Emission constraints

The schedule proposed for this program is one that allows for rapid commercialization of the GR-SI technology. As proposed the program will be completed in four years.

Commercialization of GR-SI

Rapid commercialization of GR-SI, once its performance has been verified is possible because the infrastructure is already in place to apply the retrofit technology. Architect and Engineering firms, and boiler manufacturers will be in a position to commercialize the technology and this program will provide the technical basis for application of GR-SI. The major market for GR-SI is in the Eastern and Midwestern coal producing states: Illinois, Indiana, Ohio, Kentucky, Pennsylvania and West Virginia. These states contain 47 percent of the total installed boiler capacity or a little over 88,000 MW. GR-SI is a low capital cost technology and has a significant market niche for existing boilers in the 200 to 300 MW range burning a minimum of two percent sulfur coal with capacity factors of approximately 60 percent. Commercialization will depend to a large extent up on the supply and price of natural gas.

Shortly after enactment of the Natural Gas Policy Act (NGPA) a natural gas deliverability surplus, or "bubble" developed in the United States. To the great surprise of many, this "bubble" grew rapidly and has persisted. An unused production capability of about 2.5 trillion cubic feet (TCF) exists in the lower 48 states in 1986. In addition to this domestic U.S. "bubble" the Canadian government has approved increased exports to the U.S. totaling 1.9 Tcf annually, compared to expected exports of about 1 Tcf in 1986, and has adopted market-responsive pricing in order to achieve this level. Including the unused Canadian capability, a current capacity exists to delivery at least an additional 3.0 Tcf beyond current consumption to the U.S. market -- a 20 percent surplus. This surplus is expected to persist for several years.

It has now been widely recognized that the resource base is not a constraint to U.S. natural gas supply availability. Estimates of the quantities of natural gas which will potentially be available to the marketplace under foreseeable conditions in this century have increased. In particular, the American Gas Association Gas Supply Committee now estimates that lower 48 gas wells, including gas from tight formations, will be adequate producing between 15.1 and 22.8 Tcf in the year 2000. In other words, even without Canadian gas, domestic natural gas supplies will likely be adequate to maintain current consumption and could support as much as a 30 percent increase.

There is also surplus pipeline and distribution delivery capacity. Gas deliveries in the early 1970's were nearly 23 Tcf/year. Approximately 25 percent less is currently being delivered through the system -- which has been expanded and debottlenecked. In the ENC region in 1984 deliveries were 81 percent of 1970 deliveries. Due to surplus system capacity combined with surplus gas deliverability, rather substantial delivery increases could be absorbed without raising gas prices above competitive energy sources.

Natural gas prices are declining at an accelerating rate. The average price of gas sold to electric utilities (all sizes) by gas utilities dropped 12.1 percent from January 1985 to January 1986, according to A.G.A. It will likely drop 10 - 20 percent in 1986/87 as it follows the drop in oil prices. Gas prices are not expected to regain the high levels of recent history again in this century. Coal prices have far less downward flexibility. According to EIA data coal prices to electric utilities declined only 1.7 percent from November 1985 through November 1986.

As a result of the decline in gas price and the large gas resource base the attractiveness of using gas in combination with coal to meet more stringent environmental standards is enhanced. These declining gas process appear to be not only the result of falling oil prices, but also to a continuing surplus of gas deliverability, intense gas-to-gas competition and increased use of negotiated gas carriage. Therefore GR-SI represents a near-term cost effective solution to the environmental problems which result from coal combustion.

Figure 4 presents a graphical display of the cost effectiveness of various SO_x control technologies. It can be seen that GR-SI injection allows both a greater reduction in SO_2 and is as cost effective as LIMB. Only LIMB with low NO_x burners and GR-SI provide both SO_x and NO_x control. Tables 2 and 3 presents the basis for these cost comparisons.

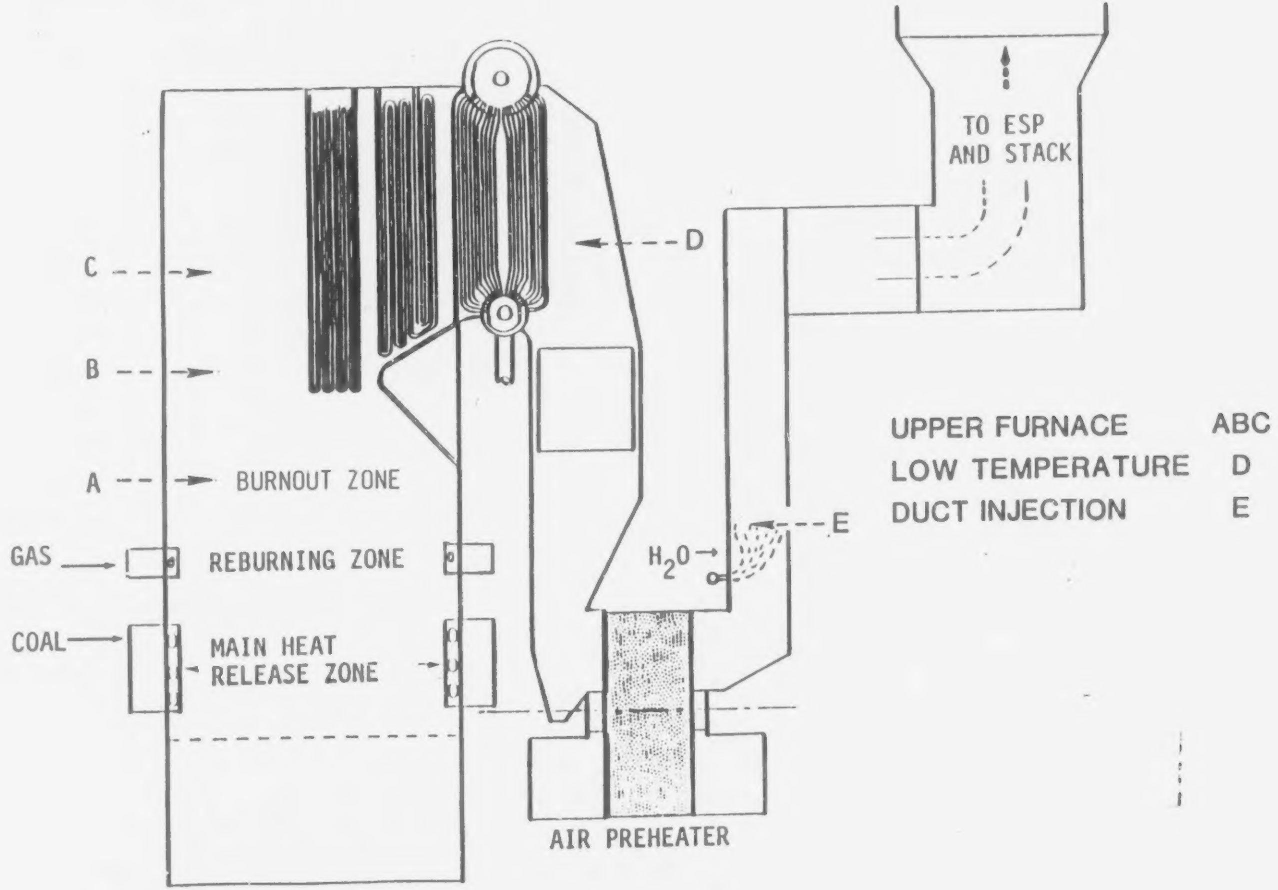
The Participants

The estimated total cost of the program proposed by EER to demonstrate GR-SI is $30,000,000. Two organizations have committed to provide co-funding for the program. The Gas Research Institute (GRI), a scientific research organization that plans, manages and develops financing for research and development programs for the mutual benefit of the gas industry and its customers, will provide $10,000,000. The Department of Energy and Natural Resources of the State of Illinois will co-fund $5,000,000. In addition, EER which is a small business with its headquarters in California and offices in Ohio, New Jersey and North Carolina will provide certain equipment and facilities for use on the program at no cost.

Three host sites (see Table 1) have agreed to participate in the program contingent upon the negotiation of a satisfactory host agreement once all the terms and conditions of the DOE contract are known. The Electric Power

Research Institute (EPRI) has expressed interest in the program as have several gas supply companies.

In conclusion, this demonstration program of GR-SI already has the financial support of two organizations and the interest of the utility industry. A successful demonstration of GR-SI will lead to the commercialization of a cost effective near term retrofit acid rain precursor control technology which will encourage the use of local coals and provide the utility industry with the flexibility to meet pollutant emission regulations with the fuel of choice at the least cost to the consumer.


TO ESP
AND STACK
C
B
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D
E
BURNOUT ZONE
GAS
REBURNING ZONE
COAL
MAIN HEAT
RELEASE ZONE
H_2O
AIR PREHEATER
UPPER FURNACE ABC
LOW TEMPERATURE D
DUCT INJECTION E

Figure 1. Gas reburn sorbent injection technologies.

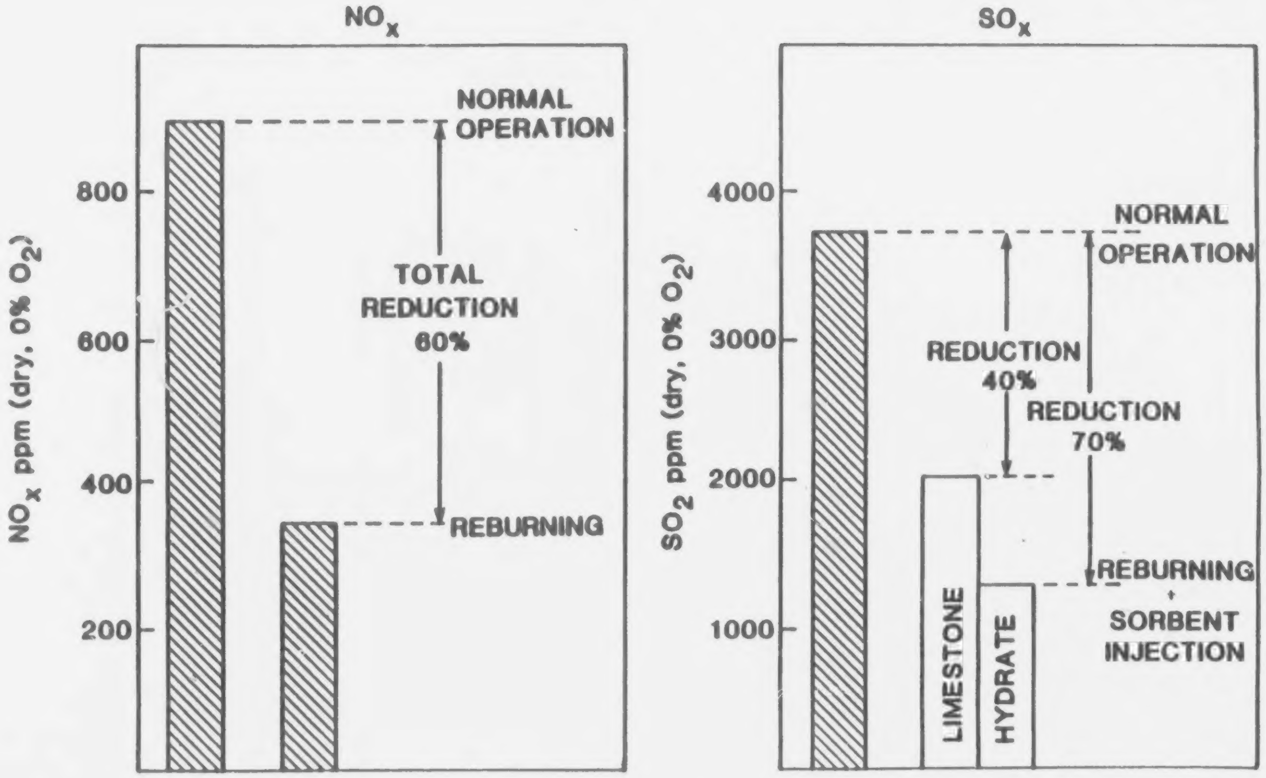

Figure 2. Reduction in acid rain precursors by GR-SI.

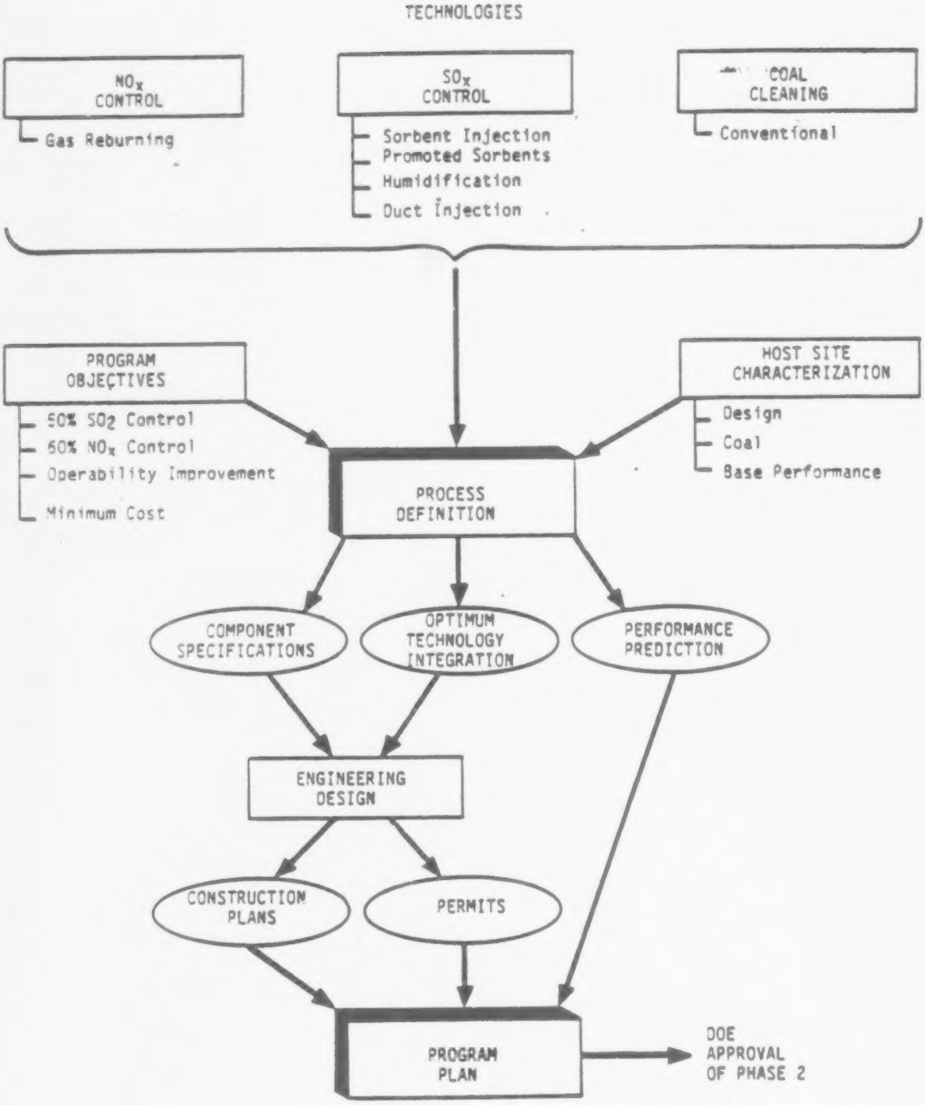
TECHNOLOGIES
NO_x CONTROL
Gas Reburning
SO_x CONTROL
Sorbent Injection
Promoted Sorbents
Humidification
Duct Injection
COAL CLEANING
Conventional
PROGRAM OBJECTIVES
50% SO_2 Control
60% NO_x Control
Operability Improvement
Minimum Cost
HOST SITE CHARACTERIZATION
Design
Coal
Base Performance
PROCESS DEFINITION
COMPONENT SPECIFICATIONS
OPTIMUM TECHNOLOGY INTEGRATION
PERFORMANCE PREDICTION
ENGINEERING DESIGN
CONSTRUCTION PLANS
PERMITS
PROGRAM PLAN
DOE APPROVAL OF PHASE 2

Figure 3. Phase 1 - Technical Approach.

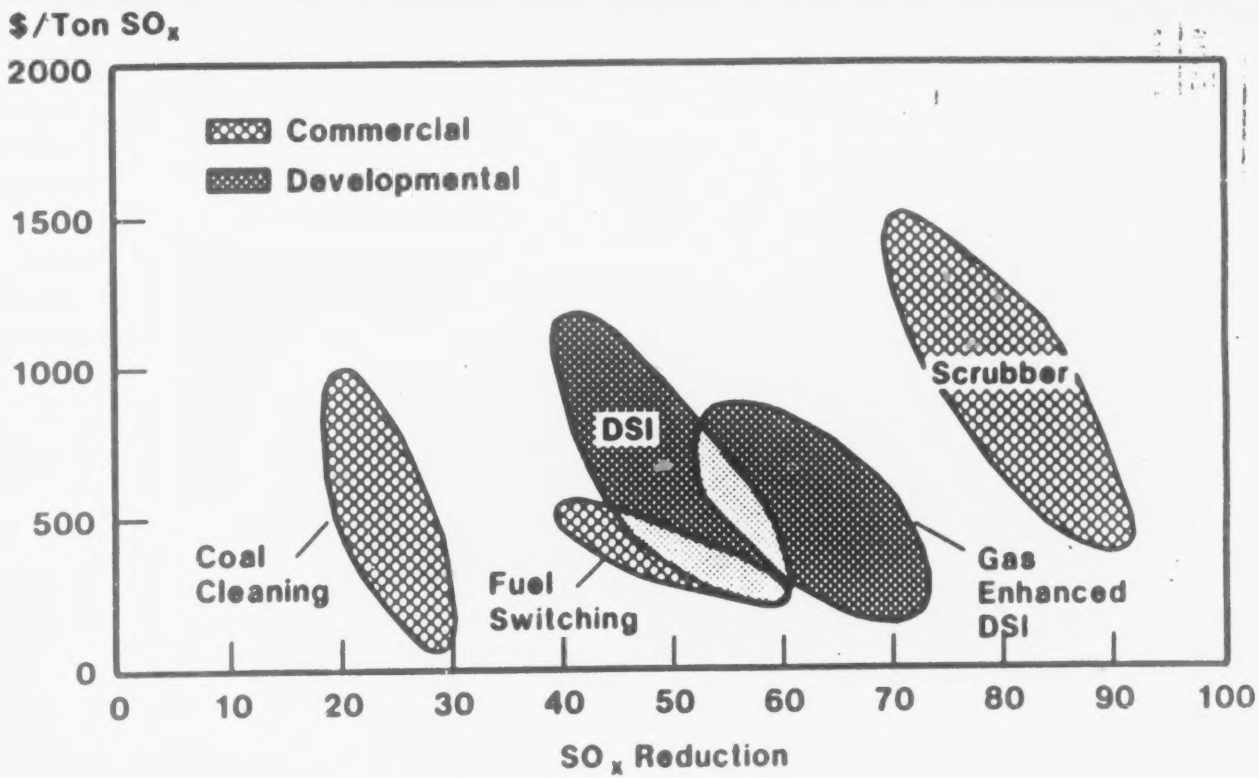

Figure 4. Cost effectiveness ranges for alternative control strategies - SO_x.

TABLE 1. CHARACTERISTICS OF HOST SITES

GENERAL			
UTILITY	ILLINOIS POWER	CILCO	CWLP
STATION, UNIT	HENNEPIN, 1	EDWARDS, 1	LAKESIDE, 7
LOCATION: STATE	ILLINOIS	ILLINOIS	ILLINOIS
CAPACITY (MW)	80	117	40
BOILER			
FIRING CONFIGURATION	TANGENTIAL	FRONT WALL	CYCLONE
CAPACITY (10^3 lb/hr)	585	850	320
MANUFACTURER	CE	RILEY	B&W
PRECIPITATOR			
LOCATION	COLD SIDE	COLD SIDE	COLD SIDE
SIZE (SCA)	223	137	333-1000
MANUFACTURER	BUELL	AMERICAN STANDARD	SMIDTH
FUEL			
COAL TYPE	ILLINOIS, BIT	BLEND ILLINOIS, BIT KENTUCKY, BIT	ILLINOIS, BIT
SULFUR (%)	3-8	1.0	3.6
GAS AVAILABILITY	YES, 100%	4 MILES	ON SITE
EMISSIONS CONTROL APPROACH			
NO_x APPROACH	GAS REBURNING	GAS REBURNING	GAS REBURNING
CONTROL (%)	60	60	60
SO_2 APPROACH	UPPER FURNACE INJECTION	UPPER FURNACE INJECTION	DUCT INJECTION
CONTROL (%)	50	50	50
ESP ENHANCEMENT	HUMIDIFICATION	HUMIDIFICATION SO_3, INJECTION	NONE

TABLE 2. BASES FOR ECONOMIC COMPARISONS OF SO_x and SO_x/NO_x RETROFIT CONTROL TECHNOLOGIES FOR POWER PLANTS

500 MW Rated Capacity -- Wall-Fired Boiler

Capacity Factor = 0.6

Coal Characteristics: 2.5% Sulfur
12.5% Ash
11,500 Btu/lb

15-Year Levelization Period

Flue Gas Desulfurization at 90% SO_x Removal

Natural Gas Reburn/Dry Sorbent Injection at 60% NO_x and 50% SO_x Control

15% Gas of Total Boiler Fuel

Gas Fuel Price Premiums of $1 and $2 per Million BTU Compared to Coal

EPRI Cost Guidelines

1986 Dollars

TABLE 3. COMPARISON OF COSTS OF SO_x AND SO_x/NO_x RETROFIT CONTROL TECHNOLOGIES FOR 500 MW WALL-FIRED BOILER

	Investment Cost		Levelized Annual Cost		1000 Tons/Yr		Cost, $/Ton	
	$Million	$/KW	$Million/Yr	Mills/KWH	SOx	NOx	SOx	SOx/NOx
Flue Gas Desulfurization	108	216	43	16	50	0	860	860
Natural Gas Reburn/ Dry Sorbent Injection								
$2/Million BTU Premium	24	48	26	10	28	7	925	740
$1/Million BTU Premium	22	45	21	8	28	7	750	600

Mr. **WALGREN**. Thank you, Dr. Heap.

PANEL 1 DISCUSSION

Well, let me ask what your experience has been in your negotiations with DOE at this point, or has that not yet gotten to that stage?

Dr. **ZAUDERER**. We started yesterday. We had a meeting with the Pittsburgh team. They prepared a package of data that they wanted Coal Tech to respond to within 30 days, and based on that information, my assumption is that we will continue to implement a contract. But I don't have a deadline; I mean, I don't have any timetable as to when that's going to happen once we respond within the 30 days.

Mr. **WALGREN**. You do not have any expectation of a certain deadline?

Dr. **ZAUDERER**. No.

Mr. **WALGREN**. Does—and that is, I gather, the case with the other two gentlemen? You are——

Dr. **WOMACK**. To the best of my knowledge, that's correct.

Mr. **WALGREN**. So you don't know how long these negotiations are going to take place. How do they resolve what the cost share would be with you? You have made suggestions, I gather. Have they committed themselves to that?

Dr. **ZAUDERER**. Well, we went over our plan yesterday, the cash contribution, the noncash contributions, and they—it appeared that that was within the guidelines of what was in the proposal request. But we haven't gotten a formal response whether that's going to be accepted or not.

Dr. **WOMACK**. In our case, I think, as you can see from the description, there are quite a number of organizations involved, and so the proposals have been fairly carefully structured by agreement among these organizations, and any substantial differences would obviously take some time to rework.

Dr. **HEAP**. In our case, the contracting officer introduced himself, explained the procedure in which they were going to work through the proposals, indicated that probably by the end of September we would receive the first set of detailed questions relating to the proposal, and they expected to negotiate probably through this year.

Mr. **WALGREN**. I see.

Dr. **HEAP**. I should add one minor point.

Mr. **WALGREN**. Yes. sir?

Dr. **ZAUDERER**. The Pittsburgh energy technology staff told us that Coal Tech is the first company they are negotiating with.

Mr. **WALGREN**. I see.

Dr. **WOMACK**. Yes; I believe we have not yet met with them.

Mr. **WALGREN**. How does the recoupment interest of DOE play in your projects? As I understand, they want to recoup this investment, and that's an add-on to the congressional——

Dr. **HEAP**. I think it depends very much upon the type of project you're proposing, and the project which I describe, we haven't got, in terms of the Department of Energy, into what they would like to do in terms of recoupment. But in this instance, all the information will be in the public domain, and in fact it's for the benefit of anyone that wants to use it. So that is a subject that's open to discussion with the Department of Energy.

Dr. **Zauderer**. In our case, we have proposed a—verbally; we did not put it into the—I am not sure whether we actually put it in writing in the proposal—but our proposal is that both the State of Pennsylvania and our industrial and private sector sponsors have repayment agreements out of future cash royalties. It is our intent to license the technology, and we are going to offer the Federal Government a schedule similar to what we are—what the private and State sector has accepted.

Dr. **Womack**. Our case is conceptually similar. I think recoupment agreements always add complexity to this kind of a project when there are multiple sponsors, and when the exact mode in which each sponsor might participate in any future commercial deployment is different, ranging from an organization such as the State of Ohio's coal development office to the utility itself. But we expect to be able to handle it.

Mr. **Walgren**. Not speaking for yourselves at this point but just—for your companies—but just as an observer of the program, does that recoupment provision skew the project selection process, in your view; I mean, the idea that you're looking for relatively immediate payback must change the kind of project that you are directly interested in and, I gather, focus it on extremely near-term and almost commercially available?

Dr. **Womack**. I think it must necessarily do that, Mr. Chairman.

Dr. **Zauderer**. I don't know what the Government's position is on that, but my experience with my private sector sponsors has been they recognize it's a long-term development effort and they have not made that a major factor in their decision to participate. It has been mainly on what the promise of the technology was for coal utilization. The private sector participants that I have had in the past have not made the repayment a primary factor in the participation.

Dr. **Heap**. I think the factor which drove the near-term application for the proposal was not so much the payback as the fact that one of the evaluation criteria was to show that you were going to have a significant impact on the use of coal in the early 1990's. That was one of the things that was important in preparing the proposal. I think that what happened in terms of the payback, originally the procurement said that you had to put a payback fund in with the proposal initially and then that was modified to, Well, we'll see what happens when the projects are selected. So things changed in the preparation of the proposal.

Mr. **Walgren**. I don't know how to make these judgments, and would not be qualified to do so, but there is a thread running through your statements where this work was developing quite well, quite with real intent prior to the DOE program. In one instance, you're talking about an extension phase and in others, obviously, some of the other supports from State departments of energy, the Ben Franklin program in Pennsylvania, the Ohio department, had been already involved.

Does this indicate that in this selection process we moved or somehow or another our approval process led us to projects that were about to happen anyway?

Dr. **Womack**. I don't believe that is necessarily so if you mean by that in the sense that these projects would have happened in this way and with this timing without the support of the clean coal technology bill. The bill asked for demonstration projects, and that necessarily meant that the projects which were suitable candidates had to have been prepared and predeveloped at laboratory and pilot scale and suitable prior work done.

In our case—you referred specifically to the two-phase LIMB project—in our case we had been fortunate enough, through the sponsorship of the EPA and the State of Ohio and the industrial sponsors, to be able to look forward to basically a single demonstration, which would have given us a certain amount of information, of two of the three technologies that I mentioned. But it's unquestionably the case that the single demonstration would have been very limited in its ability to provide a basis for engineering design, for further deployment to different kinds of boilers in different regions, without the extension or without the clean coal technology contract which we have proposed.

I think it is important again to reiterate—and I believe certainly for LIMB and I think for all these technologies—that they are going to be region and plant dependent. Prices of sorbents, exact physical design of the boilers, the precise nature of the coals, all enter into the issues of which is the most appropriate and most economical of these technologies that may ultimately satisfy.

Dr. **Zauderer**. I would like to respond to your question. I agree with Dr. Womack's statement that, being a demonstration project, it had to have a history in order to qualify. You couldn't come with something that was totally brand-new. So that's why there had to be a prior life to the project.

But more importantly, especially with the drop in oil prices, we have lost quite a bit of sponsorship in the private sector. There's the feeling the heat's off because oil now is cheap, and if the Federal Government had not come in, this project would have terminated.

Mr. **Walgren**. I see.

Dr. **Heap**. I can only say the same things. I think the Department of Energy money will help to accelerate commercialization of technology that was being studied at pilot scale, and certainly this funding will allow a broader data base, which can do nothing but help the use of coal.

Mr. **Walgren**. Well, certainly, the Congress has been very sensitive to the lack of demonstration and moving beyond the pilot stage, and we are trying to do that with this program. And that is one of the real purposes.

It is also true that we want to feel that we're making a difference, that what we encourage to happen would not have happened otherwise, and it's very important that we develop some understanding about technology development so that we can justify our adding Government resources where it's necessary. And the danger is that we—there are some areas we probably should not be adding resources, but there are some areas where we should and where nothing is happening when we don't. And it's very important to try to develop a sense for those boundaries.

Well, let me turn to my colleague from Ohio, Mr. Traficant.

Mr. **Traficant**. Thank you, Mr. Chairman.

I have a couple of brief questions—and they can be answered maybe as briefly—to each of you. What would the final outcome indicators be as far as the reduction in sulfur content in your emissions, and what does your technology, as demonstrated by past performance, show to reduce that sulfur content in the atmosphere? Dr. Womack?

Dr. **Womack**. Well, burning a typical 3 percent Ohio-Pennsylvania coal, we are estimating that the basic limestone injection process should give us 50 to 60 percent reduction, probably with the humidification coolside, may increase that to above 70 percent.

Dr. **Zauderer**. With the 1.6-percent Illinois coal, we have gotten over 90 percent reduction. In one data point in the 0.8-percent sulfur coal, we've gotten almost 97 percent reduction. We just started the Illinois tests, and based on the curve I have in the testimony, it fell on that particular curve, which we would then extrapolate to show that we could do the same thing with the 3-percent sulfur coal, maybe up to as much as 90 percent or more.

Mr. **Traficant**. What would you do with Nos. 5 and 6 Ohio coal?

Dr. **Zauderer**. It's the same sulfur content, 3 to 4 percent. Right?

Mr. **Traficant**. Yes.

Dr. **Zauderer**. Yes. So it would have the—we have not determined any difference in the sulfur concentration having an impact on this process. All the data fits on that one curve; we show that all the coals irrespective of the sulfur content fall on the same curve.[1]

Mr. **Traficant**. Doctor.

Dr. **Heap**. When you talk about SO_2 reduction from a given level with sorbent injection, you have also got to ask how much sorbent are you going to put in, because the amount of sorbent is what's taking the sulfur up. So one could say that the reduction may be between 50 and 70 percent, but what will control the application of the technology is how much particulate the total system can take.

Mr. **Traficant**. How much money would your whole project cost, Doctor, the cost of your project?

Dr. **Heap**. At the moment, the total cost that we propose is $30 million.

Mr. **Traficant**. $30 million?

Dr. **Zauderer**. $800,000.

Dr. **Womack**. The total LIMB demonstration project is a little less than $47 million, and the proposal before the Department of Energy is approximately $21 million.

Mr. **Traficant**. How about the State of Ohio, Doctor; has the State of Ohio made any commitments to you and your technology so far?

Dr. **Womack**. Yes, sir. The State of Ohio has committed to both phases of the project to the extent of about one-third of the total.

Mr. **Traficant**. One of the major concerns that has been discussed here, and continues to be an issue, is the retrofitting of these new and vast technologies to existing plants, and as you talked about earlier with Chairman Walgren here, as far as the commercial application, I didn't get quite all of that, but what I did hear—and I think what his concern is—is that not only the promise of these technologies but the actual commercial application and putting them into use and having a return for the taxpayers' investment is coming through these Federal and respective State funds now as well as some projects are going to have a heavy emphasis on private financing, multimillion-dollar projects.

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[1] The data obtained to date by Coal Tech show that the sulfur reduction is independent of the sulfur content in the coal. Therefore, the same high sulfur reduction can be achieved in Nos. 5 and 6 Ohio coals.

So, in that regard, if you might each respond, how would your particular technology be adapted and retrofitted to existing plants to be used in commercial applications, and what type of a target date and figures do you have on that? Dr. Womack?

Dr. **Womack**. Well, as I mentioned earlier, the project, the LIMB project, is intended to be a retrofit-type reduction technology. We expect, if our present demonstration plans go forward, we expect the basic LIMB data should be available in early 1989, mid-1989, and looking toward a 2-year commercialization cycle, you might look for availability installed commercially in 1991 approximately.

Coolside, the enhancement technology that I mentioned is probably 2 years behind that.

Mr. **Traficant**. What about the cost to retrofit, any additional costs to existing plants?

Dr. **Womack**. Well, of course, that's one of the outputs of the program, and it's just at this point in time, it's difficult for me to talk absolute costs and specifics. But in most cases, what we try to do is to compare the expected costs of the technology to the present commercially available technology, which is wet scrubbers; and we guess by some measures that, by eliminating the large tanks and reactors which are necessary for wet scrubbers, this project should be half the cost, perhaps less.

Mr. **Traficant**. Of the wet scrubbers?

Dr. **Womack**. Relative to wet scrubber systems. So we're looking for substantial reductions in cost relative to wet scrubbers, for sulfur; and NO_x removal, presumably that same technology would be applied even if you have the scrubber.

Dr. **Zauderer**.[2] In our case, the basic technologies, just this combustor—it's basically a can that you bolt onto an existing boiler, and that's exactly what we're doing.

Mr. **Traficant**. In advance of the system?

Dr. **Zauderer**. Yes. I don't have, because of proprietary considerations, I didn't bring along the picture of the unit that we actually have. But it just sits on the floor in front of the boiler, and the cost of installing it is about $40,000. It's really negligible.

The market penetration is strictly dependent on the price of oil. With oil in the $20-and-above range, we see a huge market.[3] Below that range, it would depend on—the biggest cost item we have is the cost of grinding the coal, and that's why I made a great emphasis on this mine waste, that this is already essentially ground and it's really available for nothing. But we could afford—with $10 oil, for example, $15 oil—we could afford to pay someone $35 a ton for the coal waste and still make a profit in converting a boiler from oil to coal. So the penetration rate really depends on just where that coal is available at the moment.

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[2] Retrofit of boilers with the Coal Tech combustor is simple. The combustor is attached externally to the wall of an existing boiler, generally at the existing burner opening, as is the case in the boiler to be used for the DOE Clean Coal project.

[3] Below that range, it [the market] would depend on the source of coal. Coal grinding is a very large fuel cost factor in our technology, and, therefore, finely ground coal waste from mine washing opeations is an attractive fuel for this combuster, even if the waste has a high ash and sulfur content.

When will the technology be developed? We are right now, I mean, in a position to manufacture multiple units with the organization and subcontractors that we have, and as soon as we finish this project, we're ready to offer it for sale, which will be within 2 years.

Mr. **Traficant**. Maybe to deviate a bit before we get to Dr. Heap, you said that you already had one of your negotiations, your first negotiations sessions, evidently September 10 with DOE.

Dr. **Zauderer**. Yesterday.

Mr. **Traficant**. Did they give you any indication as to a dollar amount, even though it wasn't finalized, but to a dollar amount that you would have, that you're cognizant of, that you can go out and expect, reasonably expect, from the Government?

Dr. **Zauderer**.[4] Well, the numbers that we proposed, in fact they suggested that there are some additional documentation requirements that we felt we would sort of, because it's a small project, we'd go easy on, and they feel that they want a little bit more than that. And they told us to go back, look at the documentation, and if there's a cost impact, we should come back.

They didn't indicate to us that the number we proposed was an absolute ceiling, but there was some flexibility around that number.

Mr. **Traficant**. Doctor?

Dr. **Heap**. Gas reburning/sorbent injection was conceived as a retrofit technology specifically. The demonstration will take approximately 4 years, and it's being done on three different boiler designs. So that if this demonstration is successful, we expect that the technology will be commercialized in the early 1990's, 1991, that kind of timeframe. And the costs will be very dependent upon the specific site. It's difficult to give a general cost.

Of course, if it's not competitive with existing technologies, then there would be no point in the process at all.

Mr. **Traficant**. Thank you. That will be all.

Mr. **Walgren**. Thank you, Mr. Traficant.

Mr. Fawell?

Mr. **Fawell**. Thank you, Mr. Chairman.

Several of my questions were along the lines which the chairman set forth to all three of you. I have been wondering myself how much the entrepreneurial spirit conceived your projects, and I assume private inducement, private funds, was the genesis. Along the line, though, apparently Ohio has given financial grants in aid. What about the other two projects heretofore, have you been able to secure financial aid from Government, local, or Federal?

Dr. **Zauderer**. In my particular case, I mention in the testimony that when we saw that initial gleam of a possibility we could control sulfur with this combustor that I decided to essentially leave a 20-year career with a fairly large energy company, and I started out Coal Tech. I spent a great deal of time with venture capital and the partnership groups, trying to raise financing for that. We did get some interest in that area. However, their time horizon is extremely short. On top of that, they are very much concerned with uncertainties regarding Government policy, such as will there be a certain ceiling on SO_2 emissions, in which case they could make a major investment in getting a technology ready and then find out that there is no need for it because there's no ceiling on emissions—as an example; I am not saying that that is the only consideration.

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[4] The cost proposed by Coal Tech was based on meeting the minimum documentation requirements. DOE asked us to review our proposed documentation and adjust the cost, if necessary.

So on that basis, we decided that we would use the traditional method that I have used in the past in my previous career, which is seek sponsorship from utilities that have R&D departments, State agencies, cooperative arrangements with universities.[5] And I ought to put in a very big plug right now for the Small Business Innovation Research Program that just got under way when Coal Tech was started, and we have won several contracts from this program. And I feel that that is going to produce a tremendous payback to the United States in terms of new technologies and new businesses that are going to be formed.

So that is the financial background, and as our programs have gotten bigger, we have gotten more Federal funds. But we started basically as a private entrepreneurial organization.

Mr. **Fawell**. But the public funding certainly then has been quite crucial in that role?

Dr. **Zauderer**. Yes. Absolutely.

Dr. **Heap**. In my case, the public funding has been absolutely crucial, because what we're talking about today represents research efforts that have gone on probably for the last 10 or maybe even 15 years, supported by the Federal Government through the EPA, looking at the basic science of NO_x control, using low-NO_x burners, the fundamentals of NO_x formation and destruction in combustion systems, the sorbent injection process has been funded, and the research effort done by EPA for the last 6 to 7 years.

So all of this work was necessary before you even got to the point of having a technology that you might be capable of applying. It's been absolutely crucial to have that funding.

Mr. **Fawell**. I don't know if Dr. Womack would want to add anything to that or not, but certainly Ohio has——

Dr. **Womack**. The sponsorship of the Environmental Protection Agency in the State of Ohio have been vital to bring us to the point of being able to propose this project, and I think that, as I tried to make clear before, I think the clean coal technology moneys are going to be essential to moving these projects towards the readiness for commercial use.

Mr. **Fawell**. Dr. Zauderer, there is a question I had. You had mentioned that the oil glut had affected what you deemed to be the ability of your project to be able to compete, for instance.

Dr. **Zauderer**. Right.

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[5] In connection with this, I wish to strongly endorse the Small Business Innovation Research Program.

Mr. FAWELL. And this betrays ignorance on my part, I am sure. But coal-fired plants, as far as they are concerned, is switching to oil a real alternative?

Mr. ZAUDERER.[6] Well, if oil gets—well, one of the big problems with oil is that prognostication has generally been not very accurate. You know, in 1980 everyone was saying $50 a barrel by the mid 1980's. One of my cousins, who is a financial executive, is now saying $5 a barrel.[7] So, you know, you can take your pick anywhere in between that range.

But the one thing that I learned in considerable advanced power systems R&D is that in view of the fact that the commodity is a variable, what you've got to do is minimize your exposure of financial capital and, therefore, cost recovery is a very, very critical part of the investment. In other words, once you go to the bank and borrow, you've got to pay back irrespective of whether the project economics change 3 months from now.[8]

So, therefore, we feel very strongly that retrofit technologies, where you use as much of the existing equipment as possible, are the most economical way of increasing coal utilization. And when I said that the price of oil impacts the penetration of the market, what I meant by that was to say with our technology we can find market niches with today's prices of oil with certain kinds of coals but as the price ranges upward, our market grows almost exponentially. Some other technologies, their breaking point is higher, and the amount of breakeven that you have depends on how much capital you have to invest.[9]

So, the simpler the retrofit, the less cost, the more rapid the recovery, and the more you can compete with lower oil prices.

Mr. FAWELL. Let me ask you this. I talked with some people recently about some of the waste byproducts utilization projects, one, for instance, where there has been no funding from any public sources, and they talk in terms of the use of—I am not quite sure how to put it—being able to take the waste byproduct, like nitrate, for instance, and use them for other purposes, such as fertilizers, et cetera. So, the waste products that you pull out, by whatever means, that doesn't get into the air, et cetera, are there byproduct uses that these projects have in mind that have a valuable at least cost aspect part of each of the projects?

Dr. HEAP. In the project I was describing, the waste is a spent sorbent, if you like, spent sorbent and flyash. It, in fact, costs you money because you've got to dispose of it. You can convert it to material for use in road filling. It's not a complete waste, but still it is a cost that you're going to have to take account of in the process.

Mr. FAWELL. But there is no byproduct there that you——

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[6] Switching the oil is an alternative if the price of coal and the capitalized cost of any future required environmental cleanup equipment is greater than the cost of oil and the capitalized cost the equipment needed to switch from oil to coal. In my opinion, extensive switching to oil could occur if the price of oil were to remain below $10/barrel for a number of years.

[7] A financial executive, in an interview in Barrons' in the summer of 1986, was quoted as predicting $5/barrel oil in the near future, and an extended period of low oil prices.

[8] From extensive advance power system analysis, I learned that since oil is a commodity with a variable price, one must minimize the capital equipment cost exposure in switching from one fuel to another. Therefore, capital cost recovery.

[9] Other technologies that have a higher capital cost for fuel switching equipment would have longer payback periods, and their use would involve greater financial risk.

Dr. **Heap**. Not as such that is a net gain to the project. It reduces the loss, if you like, of being able to use that material.

Dr. **Zauderer**. In our case, the product has very similar properties to cement because of the melting of the sorbent into the slag. The main consideration in the use of any byproducts—and this is something that we were involved in another technology—is transportation. It really doesn't pay to ship waste products more than, let's say, 100 miles; otherwise, your transportation costs start to really go up.

So, if you have a local market such as Dr. Heap mentioned—road fillers, or you need some low-grade cement as a base for a roadway or a parking lot—that would be a potential application.

Dr. **Womack**. I think what Dr. Heap said applies also to the sorbent waste created by LIMB because basically they're similar, similar processes. I certainly would expect innovation of good ideas to continue on the use of that waste to reduce the cost of disposing of it. But at present, that's not within the scope of what we are doing.

Mr. **Fawell**. I was impressed—I am easy to impress because I am a lawyer, not a chemist or scientist or physicist, et cetera—with at least this project, stating that the nitrogen could be used to create quite a profit in terms of nitrogen in fertilizers. That was the crux of my question.

Thank you very much, Mr. Chairman.

Mr. **Walgren**. Thank you, Mr. Fawell.

We have been joined by my colleague from Pennsylvania, Mr. Walker, who is interested in this area, and I would like to recognize him.

Is there a point you would like to develop?

Mr. **Walker**. Thank you, Mr. Chairman. I have no questions. I am just basically sitting in and I wish to thank you.

Mr. **Walgren**. Well, we appreciate your interest. Good.

Well, on behalf of the committee, let me thank you for your testimony and your appearance this morning. We will follow you with interest, and trust that you will keep us informed of developments.

Let me ask one other question, and that is, none of you have raised apprehensions about what you are concerned about in your interaction with DOE. If you had the ear of the Secretary or of those responsible, and you had an opportunity to say, "You know, there's something we have to be sure doesn't happen as we go forward here," what would that be?

Dr. **Zauderer**. Well, in my case, that we negotiate—that we sign the contract as soon as we finish negotiations, without waiting for the other parties to reach agreement, because of the wide diversity in dollar scope. We have a small, simple program, and we feel that we should be able to reach agreement very rapidly and move ahead with the project.

Mr. **Walgren**. The other parties being the other projects?

Dr. **Zauderer**. The projects that are $10, $50, $100 million in scope, compared to our little project.

Mr. **Walgren**. Yes?

Dr. **Heap**. I think, from our point of view, a program such as this takes time to negotiate. The Department of Energy has got to consider all of the parts to it, probably—and they do recognize that. The longer it takes to negotiate, the more expensive a project becomes. So that all that I would like to say is that we just hope that the process of negotiation just takes place in an orderly way the same way that it does in most Government procurements.

Mr. WALGREN. Dr. Womack.

Dr. WOMACK. I would echo what Dr. Heap has said and simply say that it's too early to identify any obstruction, since we have really not begun the process of negotiation. But we are confident that we're both proceeding in good faith and we intend to be successful.

Mr. WALGREN. OK. Well, thank you very much.

The next panel: Mr. Burl Davis, Energy International, Inc.; Mr. Michael Horner, Marine and Industrial Engineering and Service Division of General Electric Co.; William Peace, vice president and general manager of KRW Systems; and Robert Shannon, the president of Ohio Ontario Clean Fuels, Inc.

If you gentlemen would come forward. Welcome to the committee, gentlemen, and again your written statements will be made part of the record without more, and feel free to focus on portions of them or points that you would like to stand out in the verbal record of the hearing. Let's go forward in the order that I have called, and, in the interest of time, while we suggested 10 minutes at the outset, let's cut that back to 8 or so and know that we would like to hear the points that you feel are most important.

We will turn then to Mr. Davis.

STATEMENT OF BURL E. DAVIS, EXECUTIVE VICE PRESIDENT, ENERGY INTERNATIONAL, INC.

Mr. DAVIS. Thank you, Mr. Chairman. It's an honor to be here and to address you and your colleagues on this very important issue. We are going to discuss in detail the Proof-of-Concept Program that we have proposed for a clean coals production utilizing synthesis gas from underground coal gasification.

The project that we're talking about is an integral part of a commercial program which would result in a commercial plant in mid-1990, producing 4,000 barrels per day of liquid products and 60 million cubic feet per day of substitute natural gas.

The project team consists of Energy International, a small business; Rocky Mountain Energy, a subsidiary of the Union Pacific Corp.; and Stearns Catalytic Corp., a subsidiary of Air Products.

During the last 15 years, underground coal gasification has evolved from an interesting concept to a viable commercial process. Utilization of the technology to process coal in steeply dipping beds of coal has proven to be especially effective, as demonstrated in the 150-ton-a-day field test at Rawlins, WY, in the 1979-to-1982 timeframe.

Much of the technology that has been developed has been with the support from the U.S. Department of Energy and its predecessor. UCG permits the economic recovery of energy from coal without mining and opens up resources which are either too deep or too steep for conventional mining. UCG utilizes the same chemical reaction and produces a product gas similar to the surface fixed-bay coal gasifiers, but can produce it more economically, since mining and conversion are combined.

The process is especially effective when applied to the steeply dipping coal beds as a part of the DOE Program. This program was performed by the Gulf Research & Development Co., which was a subsidiary of Gulf Oil Corp. at that time, under a contract with DOE. The UCG product gas can be utilized either as a fuel gas or as a source of synthesis gas, the basic building block of the chemical industry.

The cost of producing low-sulfur fuel gas, anywhere from $2.50 to $3 per million BTU's, is comparable to that of searching for and developing new natural gas deposits. Utilization of the UCG product gas for synthesis gas is even more attractive. Synthesis gas costs are projected at about $1.40 per 1,000 cubic foot, competitive with synthesis gas from refarming $1.50 natural gas.

The proposed program represents a unique opportunity to launch a coal-based substitute fuel project in 1986 that will produce liquid transportation fuels and substitute natural gas at an attractive return, based on current energy prices. This was written 1 month ago.

All of the technologies that have been involved have been demonstrated on a scale that reduces the technical risks to an acceptable level.

The scope of the program would involve the commercial plant would be 5,400 tons a day of coal gasified, producing 4,000 barrels today of a premium refinery feedstock, 60 million cubic feet per day substitute natural gas. It would be located near Rawlins, WY, with a 140 million tons of this steeply dipping coal reserve.

This project has several factors that are favorable: One, it utilizes unminable coal; two, it produces a premium clean-coal fungible with petroleum products; three, it has less environmental impact than surface mining and subsequent gasification; and, four, it opens up new opportunities for clean utilization of coal.

The commercial facility consists of two different areas: One, the UCG gas production area; and two, a fairly conventional surface production plant. The gas production facility for UCG operation consists of a pair of wells drilled into the coal seam, steam oxygen which is injected into the coal seam, and gasification occurs. The product gas is similar to that produced in a surface coal gasifier and is a mixture of methane, carbon monoxide, and hydrogen. This gas is removed through the product wells and then processed with fairly conventional processing similar to that used in the petroleum industry.

The proposed plant that we are talking about would produce roughly half the volume of SNG as now the rated capacity of Great Plains, at a fraction of the capital cost. The projected break-even point of $10 per barrel liquid from $1 per million-Btu gas can make the Rawlins project attractive even today. That is a number related to recovery of operating costs, not recovery of capital.

The project that we are proposing under the DOE program is the proof-of-concept phase, which would be a program to where we would gather the final design and environmental data needed to build the plant. One modular plant would be operated along with a small-scale product conversion facility for a period of 6 months, to provide the proof of concept and environmental safety required by investors and regulatory agencies.

Completion of Phase I will require less than 10 percent of the total commercialization costs of the project and will virtually eliminate the risk on the remaining expenditures.

Related activities for the commercial facilities, such as engineering design, environmental permitting, and funding arrangements, will continue. This phase will cost approximately $25 million, and this is the basis of our proposal to the DOE.

The development of underground coal gasification has provided a means to utilize coal cleanly in traditional liquids and gaseous fuel markets. In addition, synthesis gases from UCG can be utilized to produce a wide range of chemicals, further increasing the use of clean coal. Low-sulfur fuels produced from the UCG process represent further enhancement of acid rain control by displacement through the Nation's oil and gas distribution network. UCG-based clean liquids can displace higher sulfur residual fuel oils and enhance natural gas supplies. These enhanced supplies of quality low-sulfur fuels would become fuels of choice in meeting greater reductions.

UCG can operate on coals irrespective of their sulfur content, to produce zero-sulfur-content products. This is due to the fact that sulfur is produced as hydrogen sulfide and is readily removed by conventional gas processes.

We believe that the coal-derived liquid transportation fuel SNG project represents an attractive, near-term, commercial opportunity because the project economics are attractive, the products are compatible with existing large-volume markets, the plant will utilize demonstrated technologies, the environmental and technical suitability of the resource has been demonstrated, and again this technology would prove a basis for a whole new market for coal-derived products.

The demonstration will accelerate the development of similar commercial projects once the feasibility is established. This would result in establishment of industries produced upon low-cost synthesis gas from coal, producing chemicals, fertilizers, and transportation fuels.

We feel there is a wide range of projects selected for negotiation with DOE. Ours is somewhat unique in that it attempts to put coal into a new market and other fuel applications. We feel that the range of products it represents should cover the total coal base and that the UCG technology is one that has both short- and long-term potential.

Thank you.

[The prepared statement of Mr. Davis follows:]

TESTIMONY

ASSESSMENT OF DOE CLEAN COAL TECHNOLOGY PROGRAM

SUBCOMMITTEEE on ENERGY DEVELOPMENT AND APPLICATIONS

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

9:30 am to 12:30 p.m.
SEPTEMBER 11, 1986

by

Burl E. Davis
Executive Vice President
Energy International Inc.
135 William Pitt Way
Pittsburgh, PA., 15238

RESUME

Burl E. Davis

EDUCATION AND TRAINING

B.A., Chemistry - Southern Illinois University, 1964
M.S., Physical Chemistry - University of Wyoming, 1966

PROFESSIONAL EXPERIENCE

Energy International, Inc., Pittsburgh, PA
June 1985 to present - Executive Vice President

Responsibile for corporate operations, management of projects in coal beneficiation and underground coal gasification, and has corporate responsibility for technology development for coal beneficiation, coal water fuels, and underground coal gasification. Designated program manager for the UCG/Clean Fuels Proof-of-Concept Project.

Gulf Research & Development Company, Pittsburgh, PA
1968 to 1985 - Research Associate

Developed technology related to coal conversion processes, coal surface chemistry, combustion, and coal water fuels. Managed DOE funded programs in underground coal gasification and coal water fuels.

Koppers Company, Monroeville, PA
1966 to 1968 - Research Chemist
Managed an analytical laboratory.

Natural Resources Research Institute, University of Wyoming
1963 to 1966 - Analytical Chemist
Led studies related to coal hydrogenation, mineral and coal beneficiation, mineral processing, etc.

CAPABILITIES/ACCOMPLISHMENTS

- Managed and provided technical direction for major development programs in Underground Coal Gasification, Coal-Water Fuels, coal beneficiation, and coal conversion technologies.
- Recognized world-wide for his work in Underground Coal Gasification
- Recognized nationally for his work in Coal-Water Fuels.
- Published more than 30 technical papers on coal conversion processes, combustion, coal water fuels, and seperation processes.

ENERGY INTERNATIONAL COMPANY DESCRIPTION

Energy International, Inc. (EI), was incorporated as a small business in the state of Pennsylvania on March 27, 1985 to commercialize new coal and gas technologies. The company is staffed with former Gulf employees who have developed, managed, and conducted major programs in coal beneficiation, underground coal gasification, synthesis gas processes, and coal liquefaction. The formation of the company came about during the restructuring of the merged Gulf-Chevron Corporation.

On August 26, 1985, EI contracted to purchase the coal-based technologies and proprietary processes developed by Gulf Research & Development Company over the past ten years. This technology pool is based on the research and development work conducted or managed by the staff of EI. The technologies use coal based resources for the production of high quality fuels and chemical intermediates as direct substitutes in existing markets.

The staff of EI is made up of recognized experts in non-petroleum based fuel processes and have established technical credibility with governmental agencies and major industrial firms. As GR&DC employees the EI staff had the opportunity to design, manage and implement the major programs, from bench scale product development through multi-million dollar demonstration plants, necessary to develop the skills and experience required for the formation and initial operation of EI.

EI started operation in early summer 1985 and is situated at the former Gulf Oil Harmarville Research Center (near Pittsburgh, PA). EI currently leases office and laboratory space, and equipment from the University of Pittsburgh who are operating it under the name Pittsburgh Applied Research Center (PARC).

SUMMARY

A commercial facility producing 14,000 barrels/day crude oil equivalent of hydrocarbon product is proposed for a site west of Rawlins, Wyoming. The project converts in-place coal into liquid transportation fuels and SNG at costs competitive with current market prices. EI is teaming with Rocky Mountain Energy a subsidiary of the Union Pacific Corporation, and Stearns Catalytic Corporation, a subsidiary of Air Products, in the pursuit of this project.

UNDERGROUND COAL GASIFICATION TECHNOLOGY

During the past 15 years, Underground Coal Gasification has evolved from an interesting concept to a viable commercial process. Utilization of the technology to process coal in steeply dipping beds of coal (UCG-SDB), has proven to be especially effective as demonstrated in the 150 ton/day field test at Rawlins, Wyoming. Much of the technology has been developed with support from the U.S. Department of Energy and its predecessor, ERDA.

UCG permits the economic recovery of energy from coal without mining and opens up resources which are either too deep or too steep for conventional mining. UCG utilizes the same chemical reactions and produces a product gas similar to surface fixed bed coal gasifiers but can produce it more economically since mining and part of the capital cost is avoided.

The process was especially effective when applied to steeply dipping coal seams as a part of the DOE program to develop UCG technology for steeply dipping coal seams, (UCG-SDB). The program was located in the Great Divide Basin near Rawlins, Wyoming and was performed by the Gulf Research & Development Company, a subsidiary of the Gulf Oil Corporation under a contract with the DOE. The primary objective of the Rawlins program was to demonstrate the commercial feasibility of UCG in steeply dipping beds.

The UCG product gas can be utilized either as a fuel gas or as a source of synthesis gas, the basic building block of the chemical industry. The cost of producing low-sulfur fuel gas ($2.50 to $3.00 /million Btu), is comparable to that of searching for and developing new natural gas deposits. Utilization of the UCG product gas for synthesis gas is even more attractive. Synthesis gas costs are projected at about $1.40/1000 cubic foot; competitive with synthesis gas from $1.50 natural gas.

LIQUID FUELS TECHNOLOGY

One commercial version of the practice of Fischer Tropsch technology currently produces gasoline feedstock from synthesis gas produced from coal. In recent years, new developments in the F-T type processes have led to processes for manufacturing a middle distillate type liquid suitable to the production of diesel and jet fuels. One such process has been demonstrated at the 35 barrels/day scale utilizing synthesis gas derived from natural gas. These processes can only be competitive with conventional petroleum if low-cost synthesis gas is available.

PROGRAM DESCRIPTION AND TIMING

The proposed program represents a unique opportunity to launch a coal based substitute fuel project in 1986 that will produce liquid transportation fuels and substitute natural gas at an attractive return based on current energy prices. All of the technologies involved have been demonstrated on a scale that reduces the technical risks to an acceptable level.

The following list summarizes the scope of this project.

- Feed Rate - 5400 tons/d coal gasified underground
- Product Rate - 4000 bbl/d liquids (jet, diesel, and naphtha)
  - 60 MMCF/d substitute natural gas
- Location - Rawlins, Wyoming, with 140 million tons of coal reserves.

Deciding on the right timing for a project requiring several years from inception to completion is always difficult. This is particularly true for projects involving the production of fuels from alternative energy sources, especially in light of the current volatility of petroleum prices. Nevertheless, we believe that this project has several favorable factors such as it:

- decreases the need for crude oil and natural gas imports.
- utilizes economically unminable coal.
- produces a premium, clean fuel fungible with petroleum products.
- has less environmental impact than surface mining and subsequent gasification.
- opens new opportunities for clean utilization of coal.

The project is economically attractive in spite of today's declining crude prices and over-supply.

PRODUCT MARKETS

A major objective that we have set for this project is that the products be fungible with existing fuels and be competitively priced to ensure a preferred, long-term position in the marketplace. The demand for transportation fuels, such as diesel and jet fuel, in the region of the proposed plant, is projected to continue to grow. The total production of the proposed plant can easily be absorbed with a minimum of disruption to the current supply situation. The plant site is located near a major supply point for a railroad, and Denver is a major hub for air travel.

The site is also located near a major natural gas common carrier pipeline, which could transport the byproduct SNG from the facility. It is expected that buyers of the products will agree to long-term purchase commitments which will be a major factor in obtaining project financing. Other products which could alternatively be considered are methanol and ammonia.

COMMERCIAL FACILITY

The commercial gasification facility consists of two distinct operational areas: (1) the UCG gas production facility; and (2) the main surface plant. In addition, there are the utilities and surface piping systems required to transport the injectants and product gas.

The gas production facility includes two sets of wells drilled into the coal seam: injection wells and production wells. A steam/air or steam/oxygen mixture is injected into the coal seam through the injection wells. This gas mixture reacts with the coal to produce a complex gas stream whose major components are methane, carbon monoxide, and hydrogen, together with lesser amounts of carbon dioxide and heavier hydrocarbons. This product gas is removed through the production wells. The process is operated in a series of modules, with new modules being brought on stream as old modules are burned out.

The main surface plant facility consists of tar removal, gas cooling, water removal, separators, sulfur removal and recovery units, liquids production units, an oxygen plant, process water treatment, gas compression, and other utilities.

ECONOMICS

Preliminary economic studies on a commercial UCG-Liquid Fuels Facility at Rawlins project an after-tax DCF-ROI of 26% for start-up, product prices of $28/bbl for the liquids and $2.42/mscf for SNG. The plant would require a capital investment of $275 million for a daily production of 4000 barrels of liquids and 60 million SCF of SNG. This is based upon a 25% equity, 12% debt service, and an income tax of 50%. These fuel prices compare to the DOE projections of $29.98/bbl and $2.76 for the same time frame. The projected "breakeven point" of $10 liquids and $1.00 gas can make the Rawlins Liquids Project attractive even with the specter of very low world crude prices.

The proposed plant will produce approximately 1/2 the volume of SNG as that produced by the Great Plains facility at a fraction of the capital costs. This is in addition to the 4000 barrels per day of premium refinery feedstock.

PROJECT DEVELOPMENT PLAN

The project development plan is as follows:

Phase I - Project Start-up

The approach to the development of this project will be to establish a consortium of interested organizations and companies. Each organization invited to join the consortium will bring unique capabilities to the project which will provide the broad range of strengths and technology required to successfully implement the overall clean fuels program.

Phase I is essentially complete with the formation of the project team and definition of the commercial program.

Phase II - Commercial Readiness Program

Included in Phase II will be a consortium response to the Department of Energy Clean Coal Technology PON. Funds from DOE can be used to pay up to 50% of the cost of the Proof-of-Concept phase of the project.

The Commercial Readiness Program will build on work already in progress. The commercial feasibility of producing liquid hydrocarbons using UCG-sourced synthesis gas as a feedstock has been undergoing evaluation for several years. It was initiated by GR&DC before the Gulf-Chevron merger and has been continued by Energy International, since it acquired the coal technologies from Chevron.

Phase III - Proof of Concept Program

During Phase III, one module of the plant will be operated, along with a small-scale product conversion facility, for a period of six months to provide the proof-of-concept and proof-of-environmental safety required by investors and regulatory agencies. Completion of Phase III will require less than 10% of the total commercialization project cost and will virtually eliminate the risk on the remaining expenditures. Related activities for the commercial facility, such as engineering design, environmental permitting, and funding arrangements, will continue. This phase will cost $25 million and require 30 months to complete. We are presently in negotiations with the Department of Energy for funding of this phase under the Clean Coal PON.

Phase IV - Commercial Funding

Arrangements for financing of the commercial facility will be initiated during Phase III and will be completed during Phase IV. We estimate that 3-6 months will be required after completion of the Proof-of-Concept operation to complete the permitting activity and to obtain final closing of the financial arrangements.

Phase V - Engineering, Procurement, and Construction of the Commercial Facility

The commercial plant design, detailed engineering, and procurement will require an estimated 18 months to complete. Completion of construction is estimated to require 27 months. Environmental approval and granting of the necessary state and federal permits will be a critical factor in the timing of the completion of the project. A seven year schedule from the start of the Proof-of-Concept Step to commercial operation of the plant, is projected.

RELEVANCE TO CLEAN COAL PROGRAM OBJECTIVES

The development of underground coal gasification (UCG) technology has provided another means to utilize coal cleanly in traditional liquid and gaseous fuels markets. In addition, synthesis gases from UCG can be utilized to produce a wide array of chemicals further increasing the clean use of coal.

UCG can operate on coals irrespective of their sulfur content to produce gaseous products consisting of two dominant constituents, hydrogen and carbon monoxide, plus lesser quantities of methane and light hydrocarbons, carbon dioxide, water, and hydrogen sulfide. The sulfur in the reacted coal is produced primarily as hydrogen sulfide in the raw UCG gases. Proven commercial processes, in common use by the oil, gas, and petrochemical industries, will be utilized to effectively remove hydrogen sulfide from raw UCG gas. Through these processes, one can produce virtually sulfur-free fuels and chemicals from sulfur bearing coal.

Low sulfur fuels produced from UCG represent further enhancment of acid rain control by displacement through the nation's oil and gas distribution network. UCG based clean liquid fuels can displace higher sulfur residual fuel oils and enhance natural gas supplies. These enhanced suplies of quality low sulfur fuels would become fuels of choice in meeting greater reductions in SOx emissions.

Production of chemicals from UCG derived synthesis gases can also enhance acid rain control. Many chemicals, such as ammonia and methanol, are produced from reformed natural gas. By producing such chemicals from coal via UCG, existing supplies of natural gas are freed to serve utilities and industrial boilers as substitutes to coal or high sulfur fuel oil or to achieve SOx and NOx emission reductions by means such as the Gas Research Institute "reburning" technology.

The most significant benefit is the potential for UCG derived synthesis gas. Most of the synthesis gas used in U. S. chemical plants is produced by natural gas reforming. The domestic gas market is such that natural gas prices are driven by the demand for the residential and industrial fuel and world crude prices. The resultant price structure for U.S. gas makes it impossible for U.S. chemical producers to compete with imported products made with middle eastern and Russian low-valued gas. Synthesis gas from UCG will allow these industries to compete while introducing new jobs in regions with suitable coal resources.

CONCLUSIONS

EI believes that the Coal-Derived Liquid Transportation Fuels/SNG Project presents an attractive near-term commercial opportunity because:

- The project economics are attractive based upon free-market prices with no subsidies or price supports.
- The products are compatible with existing large volume markets.
- The plant will utilize demonstrated technologies throughout.
- The environmental and technical suitability of the resource has been demonstrated.
- There is strong support for the project on the local, state, and federal levels.
- The highly qualified project team will facilitate both project execution and outside financing.

Demonstration of this technology will accelerate the development of similar commercial projects once the feasibility is established. This would result in establishment of industries based upon low-cost synthesis gas from coal producing chemicals, fertilizers, and transportation fuels.

TECHNOLOGIES SELECTED FOR CLEAN COAL SOLICITATION

Of the nine projects selected, seven are focused on steam coal applications. Only two are directed at finding new markets for coal; one for direct utilization of coal in the steel industry, and the Energy International proposal for liquid fuels from coal. The seven steam coal projects are largely hardware oriented. One wonders if more consideration should be given to those projects dealing with processes for producing higher quality products with potential for displacing fuel oil and natural gas.

RETROFIT TECHNOLOGY DEVELOPMENT PROGRAMS

Subsequent solicitations directed for retrofit technology might be directed toward oil and gas applications rather than traditional steam coal markets. This would be more likely to increase the use of coal rather than protect existing markets.

Mr. WALGREN. Thank you very much, Mr. Davis. That is a very interesting project.

Let's turn to Mr. Horner.

And let me ask Mr. Traficant if he wouldn't come and take the chair while I attend to some other things and I will be back and join you very shortly.

Mr. TRAFICANT [presiding]. Surely.

Mr. Horner.

STATEMENT OF MICHAEL W. HORNER, MARINE AND INDUSTRIAL ENGINEERING AND SERVICE DIVISION, GENERAL ELECTRIC CO.

Mr. HORNER. Mr. Traficant, members of the committee, Congressman Walker, ladies and gentlemen, good morning. My name is Mike Horner. I am the project manager for General Electric's integrated gasification steam-injected gas turbine, which we lovingly call IG-STIG, or IG-STIG, clean coal demonstration project. I appreciate this opportunity to present our views on this project, which was selected by DOE for negotiation, and our views on the clean coal technology demonstration program in general.

My testimony this morning will be abbreviated from the written submission, and I would like first to commend the Congress for establishing the clean coal technology demonstration program.

As has been noted, the current lack of market for power generation equipment and low oil and gas prices have really discouraged the private sector demonstration of efficient, low-cost environmentally clean new coal technologies. Yet, this is precisely the time that these new technologies should be demonstrated, before the utilities and the industry needs to add capacity and replace aging facilities. Congress has recognized this and took action, and we commend that.

We believe that the clean coal project that we propose is unique for several reasons: First, it takes advantage of advanced technology and the incomparable Government and private R&D investment to generate electricity from coal; second, it takes advantage of the lessons learned from the highly successful privately funded cool water integrated gasification combined-cycle project demonstration; third, it utilizes a high-temperature sulfur removal system which has been under development for some time at DOE's Morgantown Energy Technology Center, which permits a major simplification of the system and a significant reduction in sulfur emissions.

Bench-scale tests of this hot-gas sulfur-removal system have confirmed an ability to reduce sulfur compounds from a fuel gas stream by up to 99 percent in a cleanup configuration similar to that being proposed for the IG-STIG system.

In addition to the potential to control gaseous emissions to extremely low levels, as indicated, these systems will have the lowest possible solids emissions and essentially no liquid discharges from the coal conversion plant. In this plant, the primary power-producing element of the IG-STIG is the LM-5000 steam-injected gas turbine, which is trademarked "STIG." This is a 50-megawatt derivative of our highly successful family of CF6 jet engines.

This new power plant configuration has been in operation as a STIG, steam-injected gas turbine, for over 1 year at Simpson Paper in Anderson, CA. Two additional units are scheduled to go into cogeneration service later this year.

The close integration of this advanced gas turbine module with a much simplified coal gasification system is responsive to what we have been hearing from the utilities; and that is, the need for a low-cost modular 50 to 100-megawatt powerplant.

The management responsibility for the clean coal IG-STIG demonstration program has been placed with General Electric's Marine and Industrial Engines and Service Division to maximize the opportunity to commercialize the coal-fueled powerplant around this advanced technology from the LM-5000 steam-injected gas turbine and its future improved performance model. A significant part of our recommendation of this unit is that there is growth potential, significant growth potential, in the gas turbine area, which is why we have the lead position at Marine and Industrial Engines.

We have assembled a highly capable, experienced team to carry out the clean coal project, and our sister divisions in General Electric bring important strengths to this project. These divisions include: General Electric's Corporate Research and Development Center in Schenectady, NY; General Electric Environmental Services Inc., located in Lebanon, PA; and the Turbine Business Operation, also located in Schenectady, NY.

Bringing a great deal of additional experience, knowledge, and support to our team are Niagara Mohawk Power Corp. as the demonstration site in Dunkirk, NY; the Ohio Department of Development; Empire State Electric Energy Research Corp.; Peabody Holding Co., Inc.; Burlington Northern Railroad; and the Utah Power & Light Co.

Our proposed coal-fueled powerplant configuration was selected to achieve the goals of the congressionally initiated clean coal technology program. This novel plant system generates electricity by first gasifying the coal in a simplified airblown gasification and hot gas cleanup system and then burning the coal gas in a high-technology aircraft derivative gas turbine.

Steam which is generated by recovering heat from the exhaust gas is injected into the turbine to increase plant output and fuel economy. In essence, the turbine becomes a combined gas turbine and steam turbine. This simplified plant requires no oxygen plant, no fuel gas heat exchange equipment, no fuel condensate handling systems, and no steam turbine with its associated condenser cooling tower, valves and piping.

Initial discussions have been held with DOE in anticipation of a cooperative agreement. We share the concerns expressed in yesterday's testimony by Ben Yamagata of the clean coal technology coalition over the requirement for a waiting period of 30 legislative days following submission of the DOE report to Congress.

We believe that a broad base of industry participation in our project is essential to achieving early commercialization of the IG-STIG concept once it has been demonstrated. As you are aware, the Department of Energy has requested a payback plan for the Federal Government's portion of the project's costs, even though this requirement was never contemplated or required by the clean coal technology legislation. This payback requirement is making the process of pulling together this team extremely difficult. Therefore, we encourage the reexamination of this payback requirement in order to assure that it does not eliminate highly desirable clean coal demonstration projects.

We are enthusiastic about the prospects of demonstrating the integrated gasification steam-injected gas turbine powerplant, and this program offers the potential for real progress toward environmentally sound use of coal for generation of electric power in this country.

Mr. Chairman and members of the subcommittee, I thank you for this opportunity to present our integrated gasification steam-injected gas turbine project and to lend our support to the highly important clean coal technology demonstration program.

[The prepared statement of Mr. Horner follows:]

(short)

STATEMENT BY MICHAEL W. HORNER

BEFORE THE

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

SEPTEMBER 11, 1986

Good morning, I am Michael W. Horner, Project Manager for General Electric's Integrated Gasification Steam Injected Gas Turbine (IG-STIG) Clean Coal Demonstration Project. I appreciate this opportunity to present our views on our project, which was selected for negotiation by the Department of Energy, and on the Clean Coal Technology Demonstration Program.

I would like to first commend the Congress for establishing the Clean Coal Technology Demonstration Program. The current lack of a market for power generation equipment, and low oil and gas prices, have discouraged the private sector demonstration of efficient, low cost, environmentally clean new coal technologies. Yet, this is precisely the time that these new technologies should be demonstrated -- before the utilities and industry need to add capacity and replace aging facilities. Congress recognized this need and acted.

We believe the clean coal project we propose is unique for several reasons. First, it takes advantage of the advanced technology (and incomparable government and private R&D investment) in gas turbine R&D by using an aircraft derivative gas turbine to generate electricity. Second, it takes advantage of the lessons learned from the highly successful, privately funded, Cool Water Integrated Gasification Combined Cycle (IGCC) Demonstration Project. Third, it utilizes a high temperature sulfur removal system under development at DOE's Morgantown Energy Technology Center which permits a major simplification of the sytem and a significant reduction in sulfur emissions. I will briefly expand on each of these points and provide some observations on the Clean Coal Technology Program.

Before doing so, I would like to briefly describe General Electric's Marine and Industrial Engines and Service Division which will have responsibility for carrying out the General Electric Clean Coal Project. This division, which is part of General Electric's Aircraft Engine Business Group located in Evendale, Ohio, designs, builds and services advanced technology, aircraft-derivative gas turbines. Markets for our power plants include marine and industrial applications such as Navy ship propulsion, gas pipeline pumping, and cogeneration. The foundation for these derivative engines is, of course, our extensive jet engine production for military and commercial aircraft propulsion.

The primary power producing element of the IG-STIG plant is the LM5000 Steam Injected Gas Turbine (STIG) which is a 50 MW derivative of our highly successful family of CF6 jet engines. This new power plant configuration has been in operation for over a year at Simpson Paper Company in Anderson, California. Two additional units are scheduled to go into cogeneration service later this year.

Management responsibility for the Clean Coal IG-STIG Demonstration Program was placed in General Electric's Marine and Industrial Engines and Service Division to maximize the opportunity to commercialize a coal-fueled power plant around the advanced technology of the LM5000 Steam Injected Gas Turbine and its future improved performance models.

We have assembled a highly capable experienced team to carry out our clean coal project. Our sister divisions in General Electric bring important strengths to this project. General Electric's Corporate Research and Development Center, located in Schenectady, New York, has been working toward the fundamental principles of burning coal in gas turbines since the early 1970's. Our General Electric Environmental Services, Incorporated subsidiary in Lebanon, Pennsylvania specializes in air pollution control equipment and has demonstrated capability in the management of large scale construction projects. The Turbine Business Operation in Schenectady, New York is the industrial leader in the design, manufacture, packaging, and sales of large heavy duty gas turbine systems for industrial and utility applications. Bringing a great deal of additional experience, knowledge, and support to our team are: Niagara Mohawk Power Corporation as a demonstration site; the Ohio Department of Development; Empire State Electric Energy Research Corporation; Peabody Holding Company, Inc.; Burlington Northern Railroad; and Utah Power and Light Company.

Our proposed coal-fueled power plant configuration, shown in Figure 1, was selected to achieve the goals of the Congressionally initiated Clean Coal Technology Program. This novel plant system generates electricity by first gasifying the coal in a simplified air-blown gasification and hot gas cleanup system, and then burning the coal gas in a high technology aircraft derivative gas turbine as shown in Figure 2. Steam, which is generated by recovering heat from the turbine exhaust gas, is injected into the turbine to increase plant output and fuel economy. In essence, the turbine becomes a combined steam turbine/gas turbine.

Selection of an air blown gasifier, hot gas cleanup system, and high pressure ratio gas turbine for this highly integrated system has resulted in a low capital cost and high efficiency power plant which is capable of exceeding New Source Performance Standards for environmental emissions. This plant requires no oxygen plant, no fuel gas heat exchange equipment, no fuel condensate handling systems, and no steam turbine with its associated condenser, cooling tower, valves and piping.

Industry, government, and our own assessments of the utility power generation market indicate the need to add capacity in smaller, shorter cycle, lower investment increments than is possible with conventional pulverized coal plants. In configuring the IG-STIG system, emphasis has been placed on achieving a high degree of modularity, maximum factory fabrication, and a minimum of field assembly. This approach provides improved control of plant costs, quality and reliability.

Preliminary systems evaluation of the proposed IG-STIG plant configuration has been completed under a joint program by General Electric Company and the Department of Energy. This study projects a 36% near term plant efficiency, on a coal-pile to busbar higher heating value basis. This level of performance far exceeds competitive coal to electricity systems at the 50 to 100 MWe scale. Preliminary work is underway on an advanced gas turbine concept for future applications which would raise the plant efficiency to 42% on the same basis.

The IG-STIG power plant has been simplified to achieve low capital cost, short construction time, and high reliability. The previously mentioned joint study has projected capital cost savings of up to 40% compared to conventional coal-fired steam plants with flue gas desulfurization and early configurations proposed for Integrated Gasification Combined Cycle (IGCC) plants. We have estimated that this simplified IG-STIG plant can be installed within two years from time of order, considering construction requirements only.

A significant advantage of a gasification gas turbine power generation system is its ability to meet tight emission standards. This is a technical consequence of being able to remove contaminants from the fuel gas stream prior to combustion. The Cool Water IGCC Plant demonstrated this characteristic by meeting the extremely tight California regulations. The DOE Morgantown Energy Technology Center bench scale tests of hot sulfur removal systems confirmed an ability to reduce sulfur compounds from a fuel gas stream by up to 99% in a cleanup configuration similar to that being proposed for the IG-STIG system. In addition to the potential to control gaseous emissions to extremely low levels, these systems will have the lowest possible solids emissions and no liquid discharges from the coal conversion plant. A typical 50 MWe IG-STIG plant would consume 539 tons of coal per day, and would reject 53.9 tons/day of inert, dry ash, 13.3 tons/day of sulfur as a by-product. The hot gas cleanup system prevents condensation of liquids in the fuel gas stream and, therefore, avoids production of liquid waste streams. Water consumption of this plant is slightly lower than for competing coal-fired plant systems.

Initial discussions have been held with DOE in anticipation of negotiations toward a cooperative agreement. We intend to cooperate in every way to achieve an early agreement, but are concerned that the requirement for a waiting period of 30 legislative days following submission of the DOE report to Congress may result in an inordinate delay in getting a signed contract. We hope that an accommodation can be made to assure that this legislative requirement does not result in an unnecessary delay in getting the project underway.

As you are aware, the Department of Energy has requested a payback plan for the Federal government's portion of the project cost even though this requirement was never contemplated or required by the clean coal technology legislation. Even though we are making progress toward finalizing our commitment to provide 50% of the project cost for non-Federal sources, this payback requirement is making the process of pulling together a team of industry participants extremely difficult. The current lack of a market for power generation equipment, coupled with low oil and gas prices, is an added impediment to getting commitments for industry participation. We believe that a broad base of industry participation in our project is essential to achieving early commercialization of the IG-STIG concept once it has been demonstrated. Therefore, we encourage re-examination of this payback requirement in order to assure that it does not eliminate highly desirable clean coal demonstration projects.

We are enthusiastic about the prospects of demonstrating the Integrated Gasification Steam Injected Gas Turbine power plant. This program offers the potential for real progress toward environmentally sound use of coal for generation of electric power in this country. The system is largely composed of commercially demonstrated components put together in a novel configuration for low cost production of electricity and early commercialization. The new hot fuel gas desulfurization process being demonstrated as a part of the proposed program represents a key technology step in low capital cost sulfur oxide emission control with the minimum thermal efficiency penalty for the power cycle. This will allow broad use of medium to high sulfur coals in a high efficiency utility power plant of modular configuration and available in 50MWe increments.

Thank you for this opportunity to present our Integrated Gasification Steam Injected Gas Turbine Project and to lend our support to the highly important Clean Coal Technology Demonstration Program.

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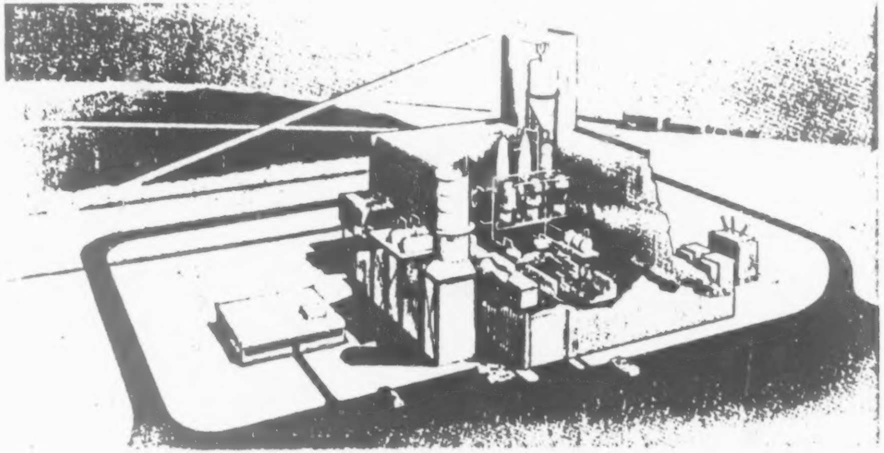
FIGURE 1

LM5000 Integrated Gasification
Steam Injected Gas Turbine Plant



GENERAL ELECTRIC

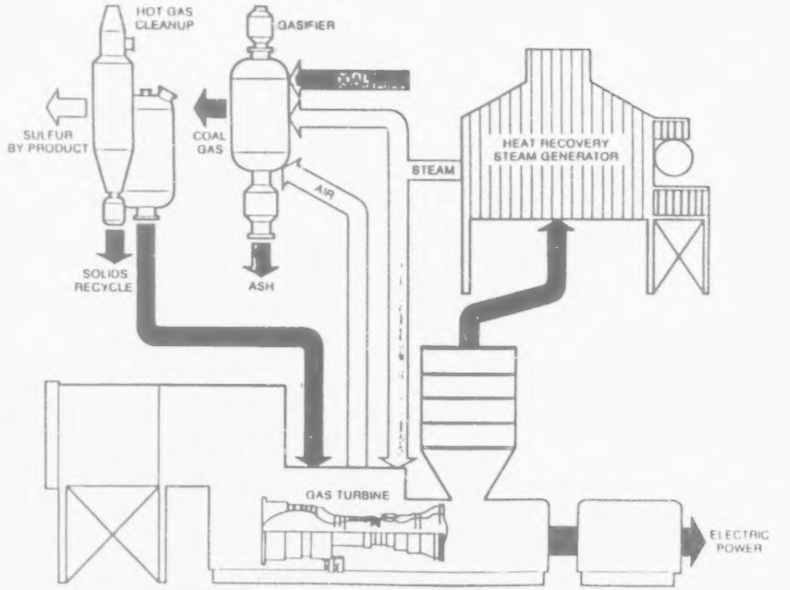
Aircraft Engine Business Group
Cincinnati, Ohio

51S-10842-081886

FIGURE 2

igstig

System Description


HOT GAS
CLEANUP
GASIFIER
COAL
SULFUR
BY PRODUCT
COAL
GAS
STEAM
HEAT RECOVERY
STEAM GENERATOR
AIR
SOLIDS
RECYCLE
ASH
GAS TURBINE
ELECTRIC
POWER

316-8652-022888

Mr. Traficant. Thank you, Mr. Horner.

Mr. Peace.

STATEMENT OF WILLIAM H. PEACE, VICE PRESIDENT AND GENERAL MANAGER, KRW SYSTEMS, INC.—APPALACHIAN PROJECT

Mr. Peace. Thank you, Mr. Traficant.

As you know, I represent KRW Energy Systems, which is a subsidiary of the M.W. Kellogg Co. Kellogg is a sponsor of the Appalachian project, which is an integrated coal gasification combined cycle project, to be located in western Pennsylvania, and which will convert high-sulfur eastern coal into 60 megawatts of clean electric power.

The project will include hot gas cleanup, which has the advantage of greatly reducing capital costs and improving overall thermal efficiency, while providing for very low environmental emissions. The KRW fluidized bed gasifier will be airblown, further improving the overall cost effectiveness of the system.

In looking at the future for integrated coal gasification combined cycle power plants, we have used the latest Westinghouse forecast as a planning base. This forecast calls for over 160,000 megawatts of new capacity to be installed by U.S. utilities before the year 2000. Based on this aggregate pattern of growth, KRW and Kellogg have forecast that industry additions of coal gasification combined cycle units will total at least 47,000 megawatts by the year 2000.

There are several reasons for what may be regarded by some as a rather bullish view of the future. Coal gasification combined cycle plants can be built on a modular basis, which reduces the risk which utilities face. Modular plants, as compared to conventional coal-fired plants, are easier to finance and assure a better fit between utility system capacity and demand. In the case of coal-gas combined cycle plants, they are fuel-flexible, positioned to capitalize on low natural gas or oil prices, and they have extremely low environmental impact.

For example, the KRW plant with hot gas cleanup has zero liquid process waste. The only liquid effluent is cooling tower blowdown. When we project a mature system from the Appalachian project prototype, we foresee capital costs under $1,000 per kilowatt and heat rates under 8,000 Btu per kilowatt-hour. These are targets which other technologies may reach with great difficulty and which are, we believe, beyond the aspirations of pulverized coal-fired plants.

We are encouraged also by many utility customers who tell us they like the simplicity of a KRW plant, airblown with hot gas cleanup. "It doesn't look like an oil refinery," customers say. As you know, electric utilities have always felt estranged from chemical processes, including scrubbers.

But we must not lose sight of the fact that we are not there yet. Much work remains to be done. A contract with the DOE must be negotiated; the plant design must be finalized, taking into account the latest improvements from KRW operations at Waltz Mill. The plant must be constructed and its operation optimized, and we must do all of this in time to be ready for a surge of utility orders beginning in about 1990. The next 4 years will be very busy years of preparation.

Let me turn now to several matters regarding the clean coal technology program. First, with respect to the distribution of awards, let me admit my bias in favor of coal gasification and say that, in principle, I believe the distribution of DOE's awards for the first nine choices is very appropriate.

More important than my own view, however, is the reputation of the DOE staff who have made the selection decision. They are highly professional people who are truly in search of excellence.

With respect to a retrofit solicitation, I have some doubts. I understand the desire to conserve existing investment, to minimize rate shock, and to reduce sulfur and nitrogen oxide emissions. My concern is whether a retrofitted plant will have a long-term levelized power cost which is competitive with a similar power from a new coal gasification combined cycle plant. Unfortunately, the driving force may not be economics; the driving force may be a mandate to reduce emissions from existing plants. If so, we simply need to understand that somewhere we will pay a price for this mandate.

Finally, let me speak to the sense of urgency I feel with respect to implementation of the Clean Coal Technology Program. Many of us suffered through a plague of indecision from the Synthetic Fuels Corp. I honestly believe that DOE is immune to that illness which, from a corporate point of view, is absolutely life-threatening. I am confident that DOE people at METC or PETC and at headquarters will work in unison to get these projects onstream quickly.

I am more concerned about two matters which have legislative implications. The first is the 30-day notice to Congress required under the administrative provisions of Public Law 99-190. Speaking for the Appalachian project, we would like to see DOE issue, and Congress accept, this notice now. If notice is given after a contract is negotiated, we add considerably more than 1 month for the critical path, and we call into question once more the Government's commitment to this program.

Second, I am concerned about the need for an environmental impact statement. As you know, under the Energy Security Act, the SFC projects were exempt from provisions of the National Environmental Policy Act. We know of no such exemption which applies under Public Law 99-190. If awards under the Clean Coal Technology Program are determined by DOE to be a major Federal action, we may be required to enter into the EIS process, which will add months, perhaps 1 year or more, to the critical path of these projects.

The irony is that these projects, by definition, include clean technologies which will continue to be subject to individual State environmental regulation. For example, from the Appalachian project we expect sulfur emissions on the order of five parts per million to the gas turbine throttle, a cleanup efficiency which is well over 99 percent. These projects will suffer a considerable reduction in their value if they face permitting delays of 1 year or more. They will cost more for the Government and the private sector. They may not be ready in time to capture the markets for which they are intended, and corporate commitment to the entire program may fade.

Let me be clear: We must avoid the time delays resulting from the EIS process in the clean coal technology program.

Mr. Chairman, I thank you for the opportunity to present these remarks. Perhaps I need only have said that the clean coal technology program is a great initiative for the economically and environmentally sound energy future of America. Thank you.

[The prepared statement of Mr. Peace follows:]

TESTIMONY

U. S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

REGARDING

U. S. DEPARTMENT OF ENERGY'S
CLEAN COAL TECHNOLOGY PROGRAM

SEPTEMBER 11, 1986

WILLIAM H. PEACE
VICE PRESIDENT AND GENERAL MANAGER
KRW ENERGY SYSTEMS INC.

FOR THE

APPALACHIAN PROJECT
SPONSORED BY
THE M. W. KELLOGG COMPANY

PREPARED 9/9/86

Mr. Chairman, ladies and gentlemen, appearing before the Energy Development and Applications Subcommittee this morning represents a major milestone for me. This is the last time I will be testifying before Congress as a representative of the alternative fuels industry, as I have accepted a new position in a different industry. At this moment I am both saddened to be leaving behind some very good friends and delighted with the real progress which is being achieved through the Clean Coal Technology Program.

Nearly everyone here has ridden a roller coaster of expectations as to the future of alternate energy in the United States. Those of us who have developed great new technologies, and who have invested years of our lives in these processes, have been despondent at times--feeling that our commitment has been wasted. At other times we feel euphoric that our dreams for the future may, at last, be realized.

As you know, I represent KRW Energy Systems, which is a subsidiary of The M. W. Kellogg Company. Kellogg is the sponsor of the Appalachian Project which is an integrated coal gasification combined cycle project, to be located in western Pennsylvania and which will convert high sulfur eastern coal into 60 megawatts of clean electric power. The project will include hot gas cleanup which has the advantage of greatly reducing capital costs and improving overall thermal efficiency

WHILE PROVIDING FOR VERY LOW ENVIRONMENTAL EMISSIONS. THE KRW FLUIDIZED BED GASIFIER WILL BE AIR-BLOWN, FURTHER IMPROVING THE OVERALL COST EFFECTIVENESS OF THE SYSTEM. KRW IS ALSO A PARTICIPANT IN THE WESTINGHOUSE PROPOSAL FOR A COAL GASIFICATION, PHOSPHORIC ACID FUEL CELL POWER PLANT, A PROPOSAL WHICH HAS CONSIDERABLE MERIT AND WHICH IS ON DOE'S "SECOND LIST."

IN LOOKING AT THE FUTURE FOR INTEGRATED COAL GASIFICATION COMBINED CYCLE POWER PLANTS, WE HAVE USED THE LATEST WESTINGHOUSE FORECAST AS A PLANNING BASE. THIS FORECAST CALLS FOR OVER 160,000 MEGAWATTS OF NEW CAPACITY TO BE INSTALLED BY U.S. UTILITIES BEFORE THE YEAR 2000. A GROWTH RATE OF 2.4% FOR SUMMER PEAK DEMAND AND CONSERVATIVE ASSUMPTIONS WITH RESPECT TO UNIT RETIREMENTS UNDERLY THE FORECAST.

BASED ON THIS AGGREGATE PATTERN OF GROWTH, KRW AND KELLOGG HAVE FORECAST THAT INDUSTRY ADDITIONS OF COAL GASIFICATION COMBINED CYCLE UNITS WILL TOTAL AT LEAST 47,000 MW BY THE YEAR 2000. THERE ARE SEVERAL REASONS FOR WHAT MAY BE REGARDED BY SOME AS A "RATHER BULLISH" VIEW OF THE FUTURE. COAL GASIFICATION COMBINED CYCLE PLANTS CAN BE BUILT ON A MODULAR BASIS WHICH REDUCE THE RISK WHICH UTILITIES FACE. MODULAR PLANTS (AS COMPARED TO CONVENTIONAL COAL-FIRED POWER PLANTS):

- O ARE EASIER TO FINANCE, AND
- O ASSURE A BETTER FIT BETWEEN UTILITY SYSTEM CAPACITY AND DEMAND.

IN THE CASE OF COAL GAS COMBINED CYCLE PLANTS, THEY ARE FUEL FLEXIBLE: POSITIONED TO CAPITALIZE ON LOW NATURAL GAS OR OIL PRICES; AND THEY HAVE EXTREMELY LOW ENVIRONMENTAL IMPACT. FOR EXAMPLE, THE KRW PLANT WITH HOT GAS CLEAN-UP HAS ZERO LIQUID PROCESS WASTE: THE ONLY LIQUID EFFLUENT IS COOLING TOWER BLOWDOWN.

WHEN WE PROJECT A MATURE SYSTEM FROM THE APPALACHIAN PROJECT PROTOTYPE, WE FORESEE CAPITAL COSTS UNDER $1000 PER KILOWATT AND HEAT RATES UNDER 8000 BTU PER KILOWATT HOUR. THESE ARE TARGETS WHICH OTHER TECHNOLOGIES MAY REACH WITH GREAT DIFFICULTY AND WHICH ARE, WE BELIEVE, BEYOND THE ASPIRATIONS OF PULVERIZED COAL-FIRED PLANTS. WE ARE ENCOURAGED, ALSO, BY MANY UTILITY CUSTOMERS WHO TELL US THAT THEY LIKE THE SIMPLICITY OF A KRW PLANT, AIR-BLOWN, WITH HOT GAS CLEAN-UP: "IT DOESN'T LOOK LIKE AN OIL REFINERY," CUSTOMERS SAY. (AS YOU KNOW, ELECTRIC UTILITIES HAVE ALWAYS FELT ESTRANGED FROM CHEMICAL PROCESSES, INCLUDING SCRUBBERS.)

BUT, WE MUST NOT LOSE SIGHT OF THE FACT THAT WE ARE NOT THERE YET. MUCH WORK REMAINS TO BE DONE. A CONTRACT WITH THE DOE MUST BE NEGOTIATED. THE PLANT DESIGN MUST BE FINALIZED, TAKING INTO ACCOUNT THE LATEST IMPROVEMENTS FROM KRW OPERATIONS AT WALTZ MILL. THE PLANT MUST BE CONSTRUCTED AND ITS OPERATION OPTIMIZED. AND WE MUST DO ALL OF THIS IN TIME TO BE READY FOR A SURGE OF UTILITY ORDERS BEGINNING IN ABOUT 1990. THE NEXT FOUR YEARS WILL BE VERY BUSY YEARS OF PREPARATION.

LET ME TURN, NOW, TO SEVERAL MATTERS REGARDING THE CLEAN COAL TECHNOLOGY PROGRAM. FIRST, WITH RESPECT TO THE DISTRIBUTION OF AWARDS, LET ME ADMIT MY BIAS IN FAVOR OF COAL GASIFICATION AND SAY THAT, IN PRINCIPLE, AS A BIASED OBSERVER, I BELIEVE THE DISTRIBUTION OF DOE'S NINE FIRST CHOICES IS APPROPRIATE. MORE IMPORTANT THAN MY OWN VIEW, HOWEVER, IS THE REPUTATION OF THE DOE STAFF WHO MADE THE SELECTION DECISIONS: THEY ARE HIGHLY PROFESSIONAL PEOPLE WHO ARE TRULY "IN SEARCH OF EXCELLENCE."

WITH RESPECT TO A "RETROFIT SOLICITATION," I HAVE SOME DOUBTS. I UNDERSTAND THE DESIRE TO CONSERVE EXISTING INVESTMENT, TO MINIMIZE RATE SHOCK AND TO REDUCE SULFUR AND NITROGEN OXIDE EMISSIONS. MY CONCERN IS WHETHER A RETROFITTED PLANT WILL HAVE A LONG TERM, LEVELIZED POWER COST WHICH IS COMPETITIVE WITH SIMILAR POWER FROM A NEW, COAL GASIFICATION COMBINED CYCLE PLANT. UNFORTUNATELY, THE DRIVING FORCE MAY NOT BE ECONOMICS. THE DRIVING FORCE MAY BE A "MANDATE" TO REDUCE EMISSIONS FROM EXISTING PLANTS. IF SO, WE NEED TO UNDERSTAND THAT SOMEWHERE, WE'LL PAY A PRICE FOR THIS MANDATE.

Finally, let me speak to the sense of urgency I feel with respect to implementation of the Clean Coal Technology Program. Many of us suffered through a plague of indecision from the Synthetic Fuels Corporation. I honestly believe that DOE is immune to that illness, which from a corporate point of view, is absolutely life-threatening. I am confident that DOE people at METC (or PETC) and at headquarters will work in unison to get these projects on stream QUICKLY.

I am more concerned about two matters which have legislative implications. The first is the "30-day Notice to Congress" required under the Administrative Provisions of Public Law 99-190. Speaking for the Appalachian Project, we would like to see DOE issue and Congress accept this notice NOW. If notice is given after a contract is negotiated, we add considerably more than a month to the critical path and we call into question, once more, the government's commitment to this program.

Secondly, I am concerned about the need for an environment impact statement. As you know, under the Energy Security Act, SFC projects were exempt from provisions of the National Environmental Policy Act. No such exemption applies under Public Law 99-190. If awards under the Clean Coal Technology Program are determined by DOE to be a "major federal action," WE ARE GOING TO BE INTO THE EIS PROCESS WHICH WILL ADD MONTHS--PERHAPS A YEAR OR MORE--TO THE CRITICAL PATHS OF THESE PROJECTS. THE IRONY IS THAT THESE PROJECTS, BY DEFINITION, USE CLEAN TECHNOLOGIES WHICH WILL CONTINUE TO BE SUBJECT TO INDIVIDUAL STATE ENVIRONMENTAL REGULATION. FOR EXAMPLE, FROM THE APPALACHIAN PROJECT, WE EXPECT SULFUR EMISSIONS ON THE ORDER OF FIVE PARTS PER MILLION, A CLEAN-UP EFFICIENCY WHICH IS WELL OVER 99%. THESE PROJECTS WILL SUFFER A CONSIDERABLE REDUCTION IN THEIR VALUE IF THEY FACE PERMITTING DELAYS OF A YEAR OR MORE. THEY WILL COST MORE--FOR THE GOVERNMENT AND THE PRIVATE SECTOR, THEY MAY NOT BE READY IN TIME TO CAPTURE THE MARKETS FOR WHICH THEY ARE INTENDED, AND CORPORATE COMMITMENT TO THE ENTIRE PROGRAM MAY FADE. LET ME BE CLEAR: WE MUST AVOID THE TIME DELAYS RESULTING FROM THE EIS PROCESS IN THE CLEAN COAL TECHNOLOGY PROGRAM.

MR. CHAIRMAN, I THANK YOU FOR THE OPPORTUNITY TO PRESENT THESE REMARKS. PERHAPS I NEED ONLY TO HAVE SAID THAT THE CLEAN COAL TECHNOLOGY PROGRAM IS A GREAT INITIATIVE FOR THE ECONOMICALLY-AND ENVIRONMENTALLY-SOUND ENERGY FUTURE OF AMERICA.

Mr. TRAFICANT. Thank you, Mr. Peace.

Mr. Shannon.

STATEMENT OF ROBERT SHANNON, PRESIDENT, OHIO ONTARIO CLEAN FUELS, INC.

Mr. SHANNON. Mr. Chairman and members of the committee, thank you for the opportunity to speak to you here today.

Our industry appreciates the initiatives of Congress in the area of development and demonstration of commercially and environmentally acceptable ways to utilize coal, our most abundant natural resource. This is absolutely essential now if we are to prepare for the needs of the future and avoid dependence on foreign sources of energy.

Under the July 25, 1986, cooperative agreement between the Department of Energy and Ohio Ontario Clean Fuels, we and our Stearns Catalytic Corp. and HRI, Inc., agreed to design, construct and operate a prototype commercial coal-oil coprocessing plant, at an estimated cost of $225,600,000. DOE's 20 percent share would be $45 million, which we would pay back from future earnings. The balance would be from Ohio, EPRI, and the private sector.

This will be a commercial demonstration of coal-oil coprocessing. We take high-sulfur coal, the higher the better, and high-sulfur residual oil, as high as 5 percent, which is now being burned in the Great Lakes area, we burn them together, we bring them together in reactors, and we cleanse both of them of all sulfur—virtually all sulfur—nitrogen, metals, and particulates which cause acid rain when combusted.

This plant would produce 12,000 barrels a day of fuels, which would be cleansed before combustion. This is precombustion. The objectionable pollutants, sulfur and nitrogen, are contained and recovered as valuable fertilizer products rather than being converted into large volumes of waste sludge. The particulates and metals are captured again before combustion and would be used as mine fill or otherwise disposed of inconspicuously.

The products can be used for power generation by utilities and industry in a variety of applications. They can be used without any retrofit in existing plants in New England, New York, California, and Florida, which now rely on OPEC or imported liquid fuels. They can be used in proposed clean, efficient combined cycle operations or cogeneration plants in the same manner as syn gas, with flexibility and simplicity in lieu of the syn gas in the gasifier integrated combined cycle.

Most important, all coal-burning plants can be simply refitted by a change of burners and be on compliance plants, without the enormous cost of systems to control sulfur, nitrogen, and particulates.

The heart of the process has already been demonstrated. Here are plants operating in Texas by Texaco [indicating]. There is another plant. There are two in the Middle East. Texaco has advised us that they will make available those plants for training of our operators and also support facilities at their—in Texas, their Port Arthur, TX, laboratories. They are also assisting us with potential investors in demonstrating these operations for the satisfaction of those investors.

What we have done, we have taken high-sulfur blends of coal and oil and modified the process. So we have stepped out in that sense, and this would be a first-of-a-type plant.

Perhaps of greater significance than the environment, perhaps, or as of as great significance, is the aspect that relates to domestic oil supply and energy security, the future dangers of which have been obscured by the current glut.

It has been long known that Appalachian coal, and Ohio, contains more Btu's than Saudi. We have routinely demonstrated this in over 400 laboratory tests and 2 years of piloting in two pilot plants, that the technical feasibility of converting that coal to light, clean fuels is absolutely proven at that level. And we have done it for half the cost of new oil supplies from enhanced oil recoveries in Texas or Florida—or Texas or California, with the vast resources of Canada, and Mexico, and Venezuela, or offshore platforms such as the Arctic or Hibernia, shale and coal oil and tarsands plants.

The coal seams Nos. 4, 5, 6, and 7 in Ohio, in which we have routinely demonstrated this technology, represent over 50 billion barrels of oil, of light, clean oil, more than any OPEC or non-OPEC supplier in the United States except possibly Saudi. The block of coal dedicated to this project, 65 million tons, represents 300 million barrels of oil, which is the largest single new reservoir found in the United States in decades.

Ohio Ontario Clean Fuel's coprocessing program meets every one of the goals of the clean coal technology program, as outlined by Mr. Bauer to the Subcommittee on Fossil and Synthetic Fuels. These are: improved performance, and cost reduction; substantial reduction in sulfur and nitrogen oxide emissions; we remove 90 percent of the sulfur and 80 percent of the nitrogen. Removal of sulfur and ash prior to burn, we do that without sludge byproduct.

Use of a broad spectrum of U.S. coals, we have used Appalachian, Illinois 6, and Western sub-bituminous. Avoidance of social and economic disruption by a massive shift to low-sulfur coals, we do that. We can use the high-sulfur eastern coal.

Modular construction, we designed this plant 3 years ago as modular construction. Low-emission rates of combined cycle, ours are the same level.

A word about negotiations. DOE has told us that we will shortly receive a series of detailed questions about our proposal. We hope that this will not be another delayed form of evaluation and, in fact, will be a basis for negotiation. We have delayed startup of the pilot plant to learn more of DOE's position at this meeting. We can no longer delay. We are going to start up the pilot plant again as quickly as we can for our final design data, which we want to have on hand by December 31. We sincerely hope that DOE will recognize these costs as part of the private sector cost sharing in the final contract.

This country urgently needs clean fuels and miners jobs, and we know how to do that. We seek some in-term recognition and accommodation from DOE so we can complete our financing. The Government component is a basic and the form and substance of the Government component is absolutely basic to any financial plan, and we need some form of in-term commitment or partial letter, partial commitment.

In a case like ours, where the private sector has developed the technology—and we have been on this program for 10 years, and we will advance the largest portion of funds—and where we intend to return the DOE funds, we believe the private sector should direct the activities, and we seek the cooperation of the committee and DOE in that regard.

Last, at this stage we need a solid commitment from the department to the project to nail down the financial commitments we have in mind from private investors. Besides the team members HRI and Stearns Catalytic, there are others awaiting a commitment from DOE. Past supporters, such as the State of Ohio and EPRI—EPRI here—have signed a contract; I have it here, a signed contract from EPRI as a participant.

[The material follows:]

EPRI
Electric Power
Research Institute

NOTE: ATTACHMENT NO. 2, WHICH CONTAINS
CONFIDENTIAL PRICING INFORMATION,
HAS BEEN DELETED.

DN#01

August 19, 1986

Lawrence I. Wisdom
Hydrocarbon Research, Inc.
P.O. Box 208
6 Clementon Road
Gibbsboro, NJ 08026

RE: EPRI Agreement RP2657-1 entitled, "Coal/Oil Co-Processing"
Amendment No. 2

Dear Mr. Wisdom:

Enclosed is one (1) fully executed copy of Amendment No. 2 to the referenced Contract.

Sincerely,

Douglas E. MacDonell

Douglas E. MacDonell
Senior Contract Administrator
Contracts Department

DEM:vs//26751L1

Enclosure

cc: C. Kulik, EPRI/APS
W. Rovesti, EPRI/APS

3412 Hillview Avenue, Post Office Box 10412, Palo Alto, CA 94303 Telephone (415) 855-2000
Washington Office: 1800 Massachusetts Ave., NW, Suite 700, Washington, DC 20036 (202) 872-9222

DEM:vs

DN#01

AMENDMENT NO. 2 TO AGREEMENT

between

HYDROCARBON RESEARCH, INC.

and

ELECTRIC POWER RESEARCH INSTITUTE, INC.
(RP2657-1)

"Coal/Oil Co-Processing"

Whereas cofunding for technical Subtask 3-7 has been secured, therekfore the parties hereby mutually agree to amend the Contract as follows:

1. In subarticle 3.1 to the Agreement, the Contract Cost Limitation is increased by $450,000 , from $450,000 to $900,000.

2. In subarticle 3.2 to the Agreement, the calendar year 1986 commitment is added as follows:

   "EPRI support of the Work under this Agreement is conditional upon annual commitment of funds. EPRI has committed $250,000 for the Work in calendar year 1986 for Phase II. This 1986 commitment, when added to previous commitments of $450,000, represents the maximum amount ($700,000) that the Contractor is authorized to expend or have committed as of the last day of 1986.

   Unexpended calendar year funds may be utilized in succeeding calendar years.

3. Paragraph 1 of the Schedule to Agreement, STATEMENT OF WORK, is revised to add the following:

   See Attachment No. 1 which is incorporated herein by reference.

4. In paragraph 3 of the Schedule to Agreement, the Period of Performance is extended by 17 months from 15-1/4 months to 32-1/4 months, commencing April 22, 1985 and ending December 31, 1987.

5. In paragraph 4.1 of the Schedule to Agreement, Cost, the maximum cost to EPRI is changed to $900,000, based on standard billing rates and expenses as set forth in Attachment No. 2.

6. Should the Contractor secure funding for either or both technical Subtasks 3-8 and 3-9, it is agreed that the scope of work shall be included as part of this contract without any additional EPRI funding above the $900,000 CCL (once this Amendment No. 2 is in place). EPRI shall then have the same data and patents rights for technical Subtasks 3-7 and 3-8 as provided for in the original contract. EPRI's data ownership and patent rights relative to technical Subtask 3-9 shall be the subject of future negotiations. However, at a minimum, EPRI will require all publishable and non-publishable data and reports as required on the original contract.

All other terms and conditions of the Agreement remain unchanged and in full force and effect.

HYDROCARBON RESEARCH, INC.

By: James B. MacArthur
Name: James B. MacArthur
Title: Vice President
Date: August 12, 1986

ELECTRIC POWER RESEARCH INSTITUTE

By: AO Farrar
Name:
Title: A. O. FARRAR
Date: Manager, Contract Administration
8/18/86

Attachment No.1
RP2657-1
Amendment No. 2

1. Statement of Work

1.2 Tasks

A. Task 1: Project Planning

The Contractor shall prepare Work Plans for Phase 2 in the same detail as described in the original contract. The Work Plan for subtask 7 shall be submitted to the EPRI project manager within thirty (30) days following the effective date of this Amendment. Provided that funding is obtained, by the Contractor, for Subtask 9 and/or 8, similiar Work Plans shall be submitted to the EPRI project manager within thirty (30) days of the date when notice of said funding is given.

B. Task 2: Project Management

Phase 2 project management shall be as stipulated in the original contract.

C. Task 3: Technical

Phase 2 of the Coal/Oil Co-Processing Program will be directed towards determining the preferred process configuration, understanding feedstock interactions and resolving questions which relate to the commercial application of coal/oil co-processing technology. The specific feedstocks and operating objectives for subtasks 7 and 8 (below) will be as recommended by the Participants Management Committee. For Subtask 9 (below) the operating objectives and feedstocks are as stated. Conduct of Subtask 9 shall be directed by the Contractor not the Participants Management Committee in order to provide data for a planned Prototype Commercial Plant project.

The current contract amendment (No. 2) only provides for carrying out Subtask 7 (Base Program for Phase 2). Conduct of Subtasks 8 and 9 is contingent upon (a) additional (other than the participants listed in Article 4 of this amended Schedule) outside funding and (b) Subtask 9 being performed by the Contractor. Should Subtasks 8 and 9 be performed as stated, they shall be included in the overall scope of work and all data, information and results shall be reported to EPRI in the same manner and detail as will be done with Subtask 7.

1.3 Subtasks

G. Subtask 7: Base Program for Phase 2

The subtasks for Subtask 3.7 are based on funding currently committed to the program of $884,324.

1. Feedstock Characterization. Any new program feedstocks nominated by participants will be characterized, as in the Phase I Program.

2. Reactivity Screening. Reactivity screening will be separated into two categories:

   a. Microautoclave Tests will be performed on any new program feedstocks plus coal/residuum pairs of interest from Phase I that were not tested.

   b. Autoclave Tests will be performed to evaluate alternate feedstock reactivity and determine preferred operating conditions.

3. Continuous Bench Unit Operations. Two bench-scale runs, each lasting about 25 days, will be performed. Plans for each of the runs are subject to Management Committee approval. The following bench runs are planned:

   Run 1- Process demonstration on Ohio No. 5/6 bituminous coal and Cold Lake residuum in two-stage process configuration. Run will be at constant operating conditions to assess catalyst aging on process performance.

   Run 2- Process variable run on low rank coal (lignite or subbituminous coal) of interest for U.S. Gulf Coast. Petroleum feed would be high metals Mexican Maya residuum or West Texas sour residuum. Run would evaluate multiple operating conditions with respect to process performance.

4. Product Characterization, Upgrading and Testing (ARC, HRI). Coal/oil co-processing products from continuous bench unit operations will be characterized with respect to their fuel qualities. Product upgrading will be assessed including naphtha hydrotreating and reforming to produce a high octane gasoline blendstock, mid-

distillate hydrotreating to jet/diesel fuel and vacuum gas oil upgrading options.

5. Economic Screening Studies. Further economic screening studies evaluating coal/oil co-processing configurations will be conducted to provide ongoing guidance to the research and development program. A comparison will be made of two-stage versus single-stage operations. Impact of differences in product slate will be assessed.

H. Subtasks 8: Expanded Program

The work in Subtask 8 is based on obtaining additional program funding through OOCF's proposal to DOE and OCDO or other sponsors.

1. Continuous Bench Unit Operations.

Run 3- Process variable run on alternate feedstock. Run would assess bituminous coal (Ohio No. 5/6 or Illinois No. 6) with residuum of commercial interest (Mayan or Cold Lake).

Run 4- Evaluate process improvements defined under program which may include improved catalyst (i.e., NiMo-324) and selective recycle.

2. Product Characterization, Upgrading and Testing. Coal/oil co-processing products from continuous bench unit operations will be further characterized with respect to their fuel qualities. In addition, their carcinogenic and multagenic characteristics will be assessed. It is understood that combustion testing on selected co-processing gas oils to determine their suitability for utility turbine and low sulfur fuel oil applications may be carried out under a separate program with utility sponsorship, and the project will supply product samples as directed by EPRI.

3. Conceptual Commercial Plant Design and Economics To date no plant has been designed for coal/oil co-processing. Economics thus far have been based on pro-rations from H-Oil® and H-Coal® investment and operating cost estimates. A conceptual commercial coal/oil co-processing plant design will be prepared in sufficient detail to support a meaningful cost estimate. Overall economics will then be determined for the addition of coal/oil co-processing to an

existing petroleum refinery to better define the relative economics of coal/oil-processing.

I. Sub-Task 9: Process Development Unit Demonstration

The work in SubTask 9 is also based on obtaining additional funding through OOCF's proposal to DOE and OCDO.

A three month Process Development Unit (PDU) Demonstration Program will be done on Ohio No 5/6 and Cold Lake residuum in a two-stage process configuration. The run will be done at the same operating conditions as in the bench-scale demonstration run and at the catalyst replacement rate determined from the bench-scale catalyst aging data. The purpose of this PDU demonstration is to confirm the scale-up of the coal/oil co-processing technology at a scale which is feasible for onstream catalyst addition and withdrawal. In addition, the PDU-scale operations will provide products in sufficient quantities for detailed upgrading evaluations and end-use testing. Cost for these activities are included in the total PDU Demonstration Program. The project will make samples of the PDU liquid products available to those organizations designated by EPRI should a separate program of utility end-use testing be conducted.

D. Task 4: Reports

Reporting follows the procedure indicated in the original contract except that separate Final Reports shall be submitted for (a) Subtasks 3-8 and/or 3-7 and (b) Subtask 3-9 according the schedule outlined in paragraph 10-Summary of Deliverable Requirements.

Summary of Deliverable requirements

	Organization, Location, and Time of Delivery
B. Technical Reports for Phase 2 (Reference Article 4, Para. 6 of Schedule)	
Monthly Progress Report	To EPRI Project Manager by the 5th of each following month.
Outline of final (Subtask 3-9)	To EPRI Project Manager by 6/30/87
Draft of Final Technical Report (Subtask 3-9)	Both reports to EPRI Project Manager by 7/31/87)
Publishable Reports Restricted Distribution Report	
Final Technical Report (Subtask 3-9) (Camera Ready)	Both reports to EPRI Project Manager by 9/30/87
Outline of final (Subtasks 3-8 and/or 3-7)	To EPRI Project Manager 90 days before contract end date.
Draft of Final Technical (Subtasks 3-8 and/or 3-7) Report per (4.2 (a))	Both Reports to EPRI Project Manager by 10/31/87
Publishable Reports	
Restricted Distribution Report	
Final Technical Report (Subtasks 3-8 and/or 3-7) (Camera-Ready)	Both reports to EPRI Project Manager by 12/31/87

Mr. **Traficant**. Would you make that available to the committee and have a copy to be made a part of the permanent record?

Mr. **Shannon**. Yes, sir.

The Ohio Technical Advisory Committee met yesterday, and I have been advised this morning that they will be announcing financial support to us next week.

There are potential investors, such as Canadian Occidental Petroleum, who have been a leader in this type of activity. They own 17.5 percent of the world's largest synthetic fuels plant, which is now being expanded at over $1.025 billion. They are onboard, and I can table their letter.

Merrill Lynch and Cieto of Japan. Others——

Mr. **Traficant**. Excuse me, Mr. Shannon. You say you have a letter from Canadian Occidental as well?

Mr. **Shannon**. Yes, I have.

Mr. **Traficant**. We would make that also a part of the record.

[The material follows:]

CANADIAN OXY
Canadian
Occidental
Petroleum Ltd.

1500, 635 - 8th Avenue South West
Calgary, Alberta, Canada T2P 3Z1
(403) 234-6700 Telex 038-21516

June 9, 1986

Mr. R.H. Shannon
Chairman and Chief Executive Officer
Ontario-Ohio Synthetic Fuels Corporation Ltd.
59 Valecrest Drive
Islington, Ontario
M9A 4P5

Dear Mr. Shannon:

Reference: Ontario-Ohio's Proposal on a Prototype Commercial
Coal/Oil Co-Processing

I would like to thank you for your prompt response to our request for representation on the above proposal to the representatives of Canadian Occidental Petroleum Ltd. and Stone & Webster Canada Ltd.. Dr. YILDIRIM has informed me that the presentations by Ontario-Ohio and HRI were very informative. He reported that the H-Oil and H-Coal technologies are maturing and low risk technologies. He is very satisfied with the results of the pilot plant tests on coal/oil co-processing. In short, I have been advised that in his opinion the co-processing technology has technical merit for commercialization and your overall program is in the right direction.

Canadian Occidental Petroleum Ltd. with its extensive holdings, development projects and operations is committed to the growth of the heavy oil and oil sands industries. We think this desired growth is achievable through efficient and reliable hydrocarbon processing technologies. CanadianOxy through its inhouse programs and joint ventures' is very involved in the enhancement of these technologies. We think that your program may fit very well with our efforts in the area of research and technology development.

In our opinion the timing, size and location of your proposed coal/oil co-processing plant are excellent. Canadian Occidental would like to achieve a level of interest in your project such that we could acquire first hand experience in the demonstration of this technology.

Page 2
Mr. R.H. Shannon
Ontario-Ohio Synthetic Fuels Corporation Ltd.
June 9, 1986

We reviewed your proposal and have a keen awareness for the funding requirements and schedule restrictions. Investment decisions of the magnitude of your proposal however, must go through a thorough internal evaluation which will take some time. Additionally, the proposed business venture involving the construction and operation of a coal/oil co-processing facility will have to be appraised in light of our corporate strategies.

Yours very truly,

J.A. McKee
President and
Chief Executive Officer

JAMcK/slc

c.c. T.H. Allen
E. YILDIRIM

Mr. SHANNON. There are others, such as State governments. Both West Virginia and Kentucky have approached. They wish to see the commercial demonstration of the technology so that these plants can be replicated in their areas and their States and utilize their resources. Also, New York State has written they want to see commercialization of the technology so that they can get domestic supplies into their power systems.

We want to be—there are others, such as Kravat Coal, which is now dedicated and holding 65 million tons to this project, as I mentioned, the equivalent of 300 million barrels of oil. We want to be sure that the cooperative agreement, as negotiated and signed by the Department, will not reserve the project for any reason other than default on the part of the contractor.

We look forward to working with the committee and DOE to achieve the objective we all seek: clean fuels and putting people back to work. Thank you.

[The prepared statement of Mr. Shannon follows:]

STATEMENT OF
ROBERT H. SHANNON, CHAIRMAN AND PRESIDENT
OHIO ONTARIO CLEAN FUELS, INC.
TO THE
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATION
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SEPTEMBER 11, 1986

Mr. Chairman and Members of the Subcommittee, Ohio Ontario Clean Fuels appreciates your invitation to testify today about its role in the Department of Energy's Clean Coal Technology Program.

This program carries out the mandate of the Congress, set forth in Public Law 99-190, to help finance the design, construction and start-up of new facilities that will demonstrate the commercial feasibility of emerging clean coal technologies. All of us in the industry heartily appreciate the initiatives of the Congress in this area. Development and demonstration of commercially and environmentally acceptable ways for utilizing our most abundant natural resource, coal, are absolutely essential now if we are adequately to prepare for the energy needs of the future and avoid unsafe dependence on foreign sources of clean energy.

On July 25, 1986, the Department of Energy (DOE) announced that as a part of the Clean Coal Technology Program it intended to negotiate a cooperative agreement with Ohio Ontario Clean Fuels (Ohio Ontario). Under this agreement, Ohio Ontario, together with its team members, HRI, Inc. and Stearns Catalytic Corporation, will design, construct, and operate a prototype commercial Coal/Oil Co-Processing plant. The total project is estimated to cost $225,600,000, of which the DOE share would be $45,000,000 or

20%. The DOE will be repaid in full from the profits of the project in operation. The balance of the funds will come from a grant from the State of Ohio, support from the Electric Power Research Institute, and private financing from both domestic and foreign investors interested in the technology.

The technology we will demonstrate is Coal/Oil Co-Processing, in which clean liquid fuels are produced from coal, residual oil, and natural gas. Our project will convert high-sulfur, high-nitrogen bituminous coal, found abundantly in Ohio and elsewhere in the Eastern United States, and poor-quality petroleum resid, also abundantly available, into more than 12,000 barrels per day of clean distillate products.

These products include liquid fuels that can be used for power generation by utilities and industry in existing liquid fuel plants, combined cycle co-generation units, and converted coal-burners. Other options include crude oil equivalents to Texas or Western Canadian light crude oil, and turbine, diesel and naphtha fuels. Naphtha is particularly well suited for octane boosting or chemical feedstocks. The process is flexible and can accommodate changes in product mix depending on marketplace needs. The current plan is to produce 7,250 barrels per day of clean utility/turbine distillate fuels, 4,500 barrels per day of naphtha, and about 530 barrels per day of propane and butane.

The fuels themselves, as well as the operation of the plant, will meet the strictest current environmental regulations. By-products of the process will include sulfur and ammonia in commercially useful quantities. Raw materials for the process are in abundant supply, and there is ample marketplace demand for the products that our process will make.

The heart of Coal/Oil Co-Processing is the ebullated-bed reactor technology developed and patented by HRI, Inc. The co-processing step, which is based on the commercially proven H-Oil and H-Coal processes that are proprietary to HRI, has been successfully proven in continuous pilot plant operations that have been run for extended times. All other process steps are proven commercial processes in full scale operation today.

The process lends itself well to increases in magnitude up to major commercial refinery size. There are no process conditions or equipment items that will put constraints on future expansion. The plant is suitable for replication in other appropriate areas near power plants and refineries throughout the country, such as California and Florida, where demand for clean energy is the highest. The process operates at conditions such as temperature and pressure that are well within the limits of current commercial practice. No exotic or beyond-the-state-of-the-art equipment or operational procedures will be necessary. Operation will be safe and reliable.

Ohio Ontario, which will be responsible for acquiring the necessary private financing, will be the owner of the plant and prime contractor to the DOE. Stearns Catalytic will be responsible for over-all project management, including construction, start-up, and operation. HRI will be responsible for the Coal/Oil Co-Processing portion of the plant and will provide start-up assistance and operations support. Texaco has indicated preliminary interest in training our operations people and possibly assisting in start-up.

We at Ohio Ontario believe that our project fits well into a balanced program to bring into commercial application technologies that will burn coal cleanly. Indeed, we believe that our co-processing project is essential to the balance of such a program.

From the economic point of view, our process requires far less capital investment per barrel of capacity than frontier off-shore, tar sand, enhanced heavy oil, or shale oil projects. The capital cost for a Coal/Oil Co-Processing plant would be about half the cost of a coal liquefaction plant per unit of output capacity. Costs for co-processing are more than competitive with the costs of upgrading residual oil alone, because the relatively low cost of coal makes the coal/resid blend to the co-processor cost significantly less than resid to an upgrader. Even when energy prices decline generally, the co-processing facility can maintain profit margins, because as the prices of the high-quality, low-sulfur utility fuel with which we will compete come down, so will our feedstock costs of coal, high-sulfur residual oil and natural gas.

Of even greater significance, the process utilizes abundant high-sulfur, high-nitrogen coal, and high-sulfur heavy oil. In Ohio alone, the reserves of such coal represent a resource potential of 50 billion barrels. If this resource can be tapped for use in energy generation in a manner that is consistent with environmental requirements we can reduce and perhaps eliminate our long-term dependence on foreign sources of energy and at the same time clean up and enhance our environment. By converting high-sulfur and high-nitrogen raw materials into low-sulfur, denitrogenized fuels before burning, we will provide competitively priced fuel for utilities that can enable them to avoid emitting the sulfur dioxide and nitrogen oxide components that are believed to be a cause of acid rain and to save the costs of retrofitting their plants to clean up their exhausts after burning. The only retrofitting costs will be very minor ones - to convert existing coal-fired plants to operate on clean fuels and to erect storage tanks. This contrasts with the enormous costs utilities face to control sulfur, nitrogen, and particulates by other means. I have attached to this statement a more extended economic analysis of these potential benefits.

In short, Coal/Oil Co-Processing meets every one of the goals of clean coal technology outlined by Acting Assistant Secretary Donald Bauer in his statement to the Subcommittee on Fossil and Synthetic Fuels, House Committee on Fossil and Synthetic Fuels, on March 20, 1986:

-- improved environmental performance and significant cost reduction

-- substantial reduction in emission of sulfur dioxide and nitrogen oxides

-- removal of both sulfur and ash from coal prior to burn without sludge by-product common in lime or limestone scrubbers

- use of a broader spectrum of U.S. coals without excessive burdens on air quality
- opportunity to retrofit existing plants to burn clean liquid fuels, avoiding premature shut-down or installation of high-cost conventional clean-up equipment
- a means to avoid the social and economic disruption that massive shift to low sulfur coal would entail
- efficiencies and lower costs of modular construction and lower emission rates of combined cycle power concept

Our prototype co-processing plant will provide an initial set of technical, economic, operational, environmental, health and safety data at sufficient scale to enable the private sector to make rational and nationally advantageous decisions on appropriate process and control technologies for the future production of energy.

A word now about the negotiations that are shortly to begin. As I stated earlier, we were notified on July 25 that we were among nine proposers that had been selected for negotiation of cooperative agreements. We have been told that we will shortly receive a series of detailed questions about our proposal that will serve as the basis for negotiating the agreement. Ohio Ontario and its team members eagerly await these questions, because we are anxious to get our project underway.

Since our project has already been selected, we hope that the detailed questionnaire we are to receive will not be another and delayed form of evaluation but will in fact provide the understanding necessary for negotiation.

Upon hearing of our selection, we started certain critical path bench tests of this process at our own expense. We hope the Department will recognize these costs as part of the private sector cost-sharing.

Lastly, at this stage, we need a solid commitment from the Department to the project to enable us to nail down the financial commitments we have in hand from private investors. Besides our team members, HRI and Stearns Catalytic, there are others awaiting that solid commitment from DOE:

-- past supporters, such as the State of Ohio and EPRI

-- potential investors, such as Canadian Occidental Petroleum, Merrill Lynch, and C. Itoh of Japan

-- state governments, such as those of West Virginia and Kentucky, that wish to see commercial demonstrations of plants that could be replicated in their areas to utilize their resources

-- coal companies, such as Cravat Coal Company which has dedicated 65 million tons of coal to our project, the equivalent of 300 million barrels of oil.

We want to be sure that when the cooperative agreement is negotiated and signed the Department will not reserve the right to drop out of the project for any reason other than default upon the part of the contractor. DOE will be assuming only 20% of the total cost of the project (to be repaid from profit), and 80% is to come mostly from private investors. In the first stage, Phase I, which heavily concerns environmental studies required by Federal laws and preliminary design work, we are asking the Department to assume 50% of the cost, that is, about $17,900,000. If the Department insists on a right to drop out of the project, it will be very hard to attract private capital for the other half of the Phase I costs. If the Department were to drop out, the private investors would have nothing on which they could look for a return.

In general, when the Department negotiates a cooperative agreement that involves such heavy cost-sharing by the private sector, it enters a world that is quite different from the situation where it contracts for the full cost of a project. We believe that the Department must accommodate itself to marketplace realities. While its role is essential, it is not predominant. The Department must not lose sight of the fact that it is in a sharing role with the private sector, a kind of partnership relationship, and it should guide its activities accordingly. In cases such as ours, where the private sector has developed the technology, will advance by far the larger portion of the funds, and intends to repay the DOE portion, the private sector should, we believe, direct the activities. The laws and regulations the Department operates under must, of course, be fully met. At the same time, in the areas in which the Department has discretion, it must exercise that discretion in a cooperative, non-adversarial manner.

All of us want the same thing: a responsible, well-managed, adequately financed project that will demonstate the commercial attractiveness of a new energy technology that is environmentally sound and has exciting potential for securing our energy future. We at Ohio Ontario will do our absolute best to achieve this result.

Thank you.

Attachments

(1) Biography of R. H. Shannon

(2) Program Overview - Prototype Commercial Coal/Oil Co-Processing Plant

(3) Comparative Economic Analysis of Coal/Oil Co-Processing with Coal Liquefaction, In-Situ Enhanced Heavy Oil Recovery and Upgrading, New Off-Shore Frontier Operations, Tar Sand Sources and Oil Shale.

ROBERT H. SHANNON

Mr. Shannon has over fifteen years' experience on the management committee of a multi-national company. He is responsible for the operation of a number of petrochemical and other plants. He was also on the corporate R&D planning committee with particular responsibilities for leading efforts to develop advanced technologies for conversion of coal and bitumen.

For the past ten years Mr. Shannon has evaluated technology and projects on behalf of a number of oil and gas companies and various governments.

His work on co-processing began in 1977 in evaluation of the technical features of converting lignite in heavy oil. Various technical and economic evaluations were done on various combinations of coals and oils, at various locations and confluences of raw materials in North America.

This culminated in the selection of Appalachian coal as most amenable for conversion of the lignite, sub-bituminous and bituminous coals evaluated and the practicality of locating in the Appalachian region. He formed Ontario Ohio Synthetic Fuels in 1983 to build a commercial plant.

For four years, he has been technical advisor to the Board of Scotia Coal Synfuels, a consortium of Gulf, PetroCanada, Nova, and Alberta Co. (a gas producer), Devco (a coal company), and the Governments of Canada and Nova Scotia. During this period of time, a number of pilot plant runs on the liquefaction of a high volatile bituminous coal were undertaken at HRI, Inc. and Chevron.

He initiated the program of coal/oil co-processing for the State of Ohio Coal Development Office in which pilot plant runs were conducted in facilities of Kerr McGee and HRI, Inc.

He also managed the market siting studies and coal supply studies as requested by the Ohio Office of Coal Development.

Ohio Ontario Clean Fuels, Inc.

Prototype Commercial Coal/Oil Co-Processing Plant

PROGRAM OVERVIEW

TEAM MEMBERS

Ontario-Ohio Synthetic Fuels Corporation Ltd.
59 Valecrest Drive
Islington, Ontario
Canada M9A 4P5
(416) 236-2359
(416) 284-0360

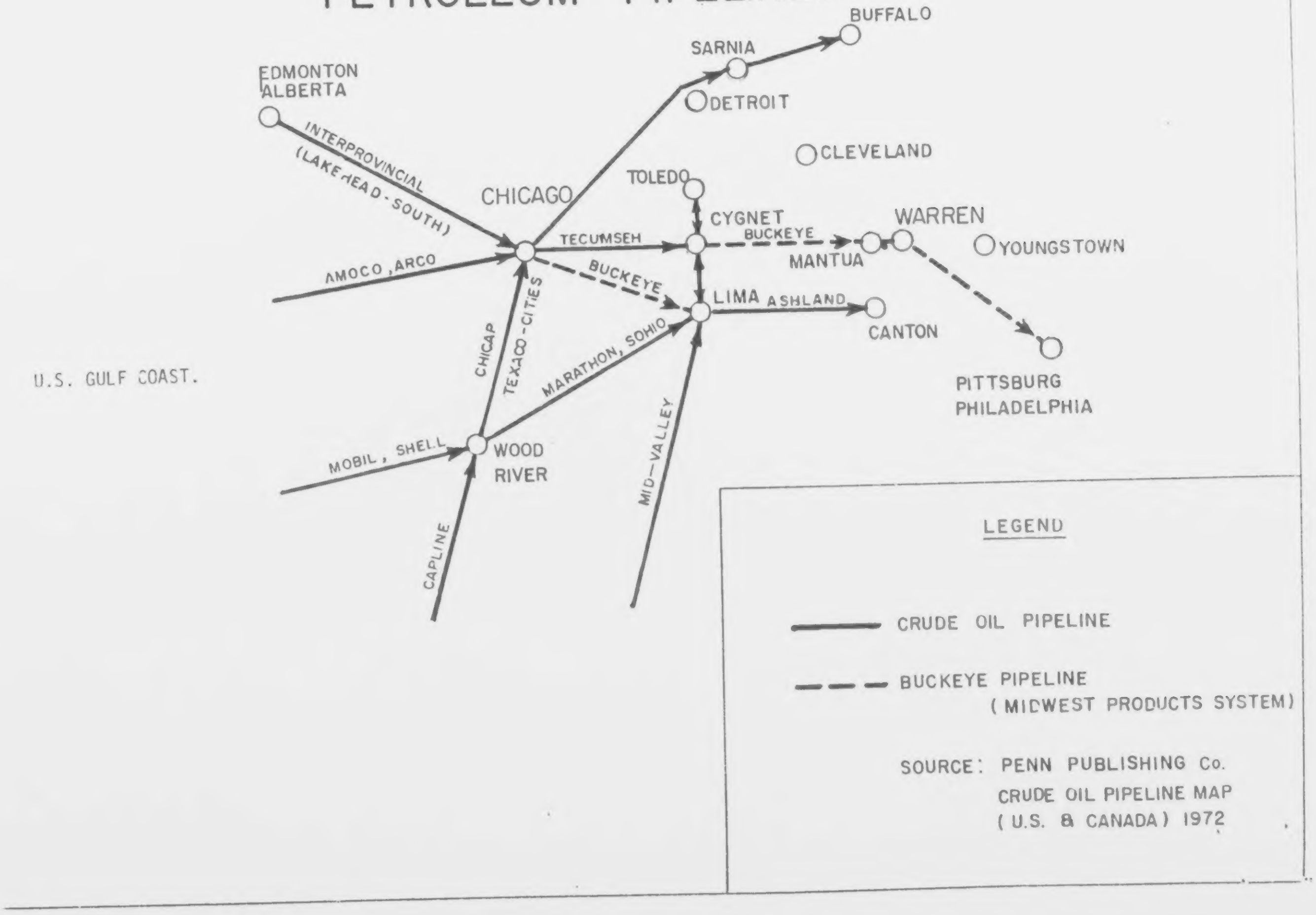
Ohio Ontario Clean Fuels Inc.
c/o R. M. Robbins & Associates Ltd.
P.O. Box 671
2921 Youngstown Rd., S.E.
Warren, Ohio 44482

HRI Inc.
P.O. Box 6047
New York and Putnam Avenues
Lawrenceville, NJ 08648

Stearns Catalytic Corporation
Centre Square West
1500 Market Street
Philadelphia, PA 19102

Synergy in Energy

PETROLEUM PIPELINES


BUFFALO
SARNIA
EDMONTON ALBERTA
DETROIT
CLEVELAND
INTERPROVINCIAL (LAKEHEAD-SOUTH)
CHICAGO
TOLEDO
CYGNET
WARREN
YOUNGSTOWN
TECUMSEH
BUCKEYE
MANTUA
AMOCO, ARCO
BUCKEYE
LIMA
ASHLAND
CANTON
U.S. GULF COAST.
CHICAP
TEXACO-CITIES
MARATHON, SOHIO
PITTSBURG
PHILADELPHIA
MID-VALLEY
MOBIL, SHELL
WOOD RIVER
CAPLINE
LEGEND
CRUDE OIL PIPELINE
BUCKEYE PIPELINE (MIDWEST PRODUCTS SYSTEM)

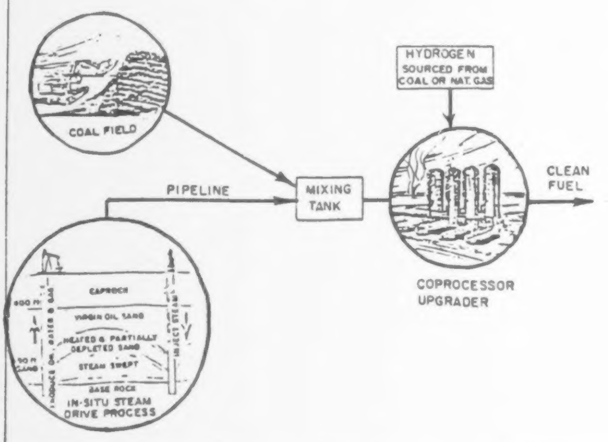
SOURCE: PENN PUBLISHING Co.
CRUDE OIL PIPELINE MAP
(U.S. & CANADA) 1972

COMMERCIAL PROTOTYPE COAL/OIL CO-PROCESSING PLANT

EXECUTIVE SUMMARY

We have provided a team, a process and a project which will bring into being a plant which is economically viable and environmentally acceptable. The feedstock to this plant, a slurry of coal and oil will provide new and expanded uses and markets for high sulfur Ohio coals and low grade residual oils. The products which will be clean liquid fuels can be used for power generation without producing acid rain. The products can also be used as a domestic source of transportation fuels to replace declining North American supplies which are expected to be critical in the 90's.

Coal/Oil Co-Processing


COAL FIELD
HYDROGEN SOURCED FROM COAL OR NAT. GAS
PIPELINE
MIXING TANK
CLEAN FUEL
COPROCESSOR UPGRADER
CAPROCK
VIRGIN OIL SAND
HEATED & PARTIALLY DEPLETED SAND
STEAM SWEPT
BASE ROCK
PRODUCE OIL, WATER & GAS
INJECT STEAM
IN-SITU STEAM DRIVE PROCESS

THE PROCESS

The process to be utilized in the project is **coal/oil co-processing**, utilizing ebullated-bed reactor technology, in which clean liquid fuels are produced from coal, petroleum, residual oils and natural gas. The attractiveness of the process is shown in the following salient points+

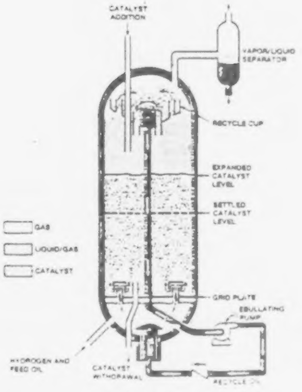
* This is a demonstrated clean coal technology. The process produces clean fuels by removing virtually all of the sulfur and nitrogen from high sulfur coals and residual oils producing clean fuels. The sulfur and nitrogen are captured on site as valuable industrial products elemental sulfur and ammonia. There is no large rejection of unusable material such as with power plant scrubbers. There is a purge stream representing 12% of the feedstock which can be used on site for fuel or sold for fuel. The final reject after burning is a hard insoluable slag.

* The overall plant, composed of a series of discrete process steps has a high degree of technical confidence: all steps except the co-processing unit are proven commercial processes, in full scale operation today.

* The overall process is very attractive from an environmental point of view. We are confident, based on the performance of existing commercial installations of the various components, that the proposed plant will operate well within the limits of current and proposed environmental limits. HRI and Stearns Catalytic have demonstrated, in operations of large scale advanced coal liquefaction units and residual oil upgrading plants, the ability to operate a complex coal and oil processing unit meeting environmental regulations.

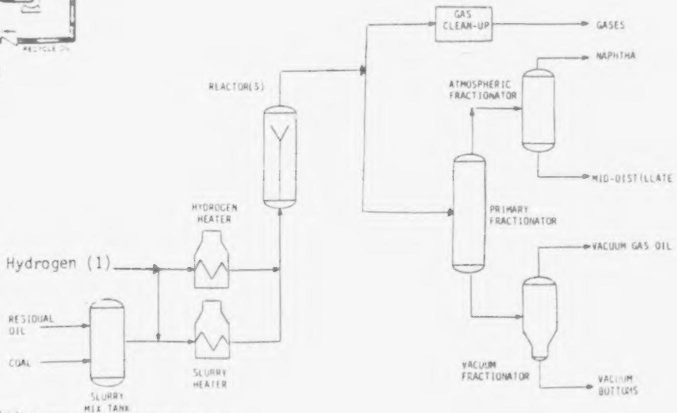
* The process lends itself well to increases in magnitude, up to major commercial refinery scale. There are no process conditions or equipment items that will put constraints on future enlargement.

* The process operates at conditions (temperature, pressure, etc,) well within the limits of current commercial practice. There are no instances where exotic or beyond the state-of-the-art equipment operations practices. The overall process can be shown to lend itself to safe and reliable operation.


CATALYST ADDITION
VAPOR/LIQUID SEPARATOR
RECYCLE CUP
EXPANDED CATALYST LEVEL
SETTLED CATALYST LEVEL
GAS
LIQUID/GAS
CATALYST
GRID PLATE
EBULLATING PUMP
HYDROGEN AND FEED OIL
CATALYST WITHDRAWAL
RECYCLE OIL

REACTOR

COAL/OIL CO-PROCESSING SIMPLIFIED PROCESS FLOW DIAGRAM


GAS CLEAN-UP
GASES
NAPHTHA
REACTOR(S)
ATMOSPHERIC FRACTIONATOR
MID-DISTILLATE
HYDROGEN HEATER
PRIMARY FRACTIONATOR
VACUUM GAS OIL
Hydrogen (1)
RESIDUAL OIL
COAL
SLURRY HEATER
SLURRY MIX TANK
VACUUM FRACTIONATOR
VACUUM BOTTOMS

(1) From coal or natural gas.

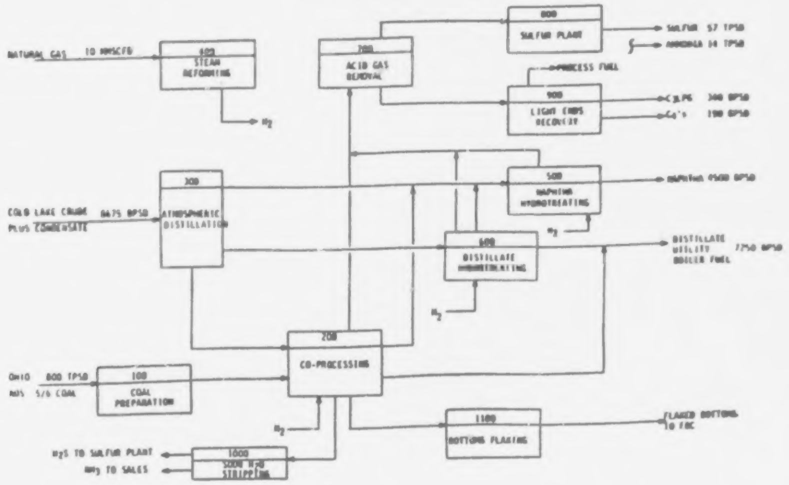
THE PROJECT

The proposed project is a prototype commercial coal/oil co-processing plant to be located in Ohio. This plant will convert high sulfur high nitrogen Ohio bituminous coal and poor quality petroleum residual oils to produce 12,280 barrels per day of clean fuels meeting the strictest environmental regulations.

The specific project is a unique combination of site availability, feedstock supplies, product markets and financing backing. The proposed project will permit evaluation of the combination of proven process steps combined into a total plant entity, producing sufficient quantities of products to permit meaningful evaluation of product markets. The scale proposed is sufficiently large to demonstrate the reliability and the environmental attractiveness of the project. The successful implementation of this project will provide and adequate and appropriate basis for financing, designing, permitting and operating other, even larger, plants.

PROTOTYPE COMMERCIAL CO-PROCESSING PLANT PROPOSAL

OVERALL BLOCK FLOW DIAGRAM


NATURAL GAS 10 MMSCFD
400
STEAM REFORMING
H_2
700
ACID GAS REMOVAL
800
SULFUR PLANT
SULFUR 57 TPSD
AMMONIA 14 TPSD
PROCESS FUEL
900
LIGHT ENDS RECOVERY
C_3 LPG 300 BPSD
C_4's 190 BPSD
300
ATMOSPHERIC DISTILLATION
COLD LAKE CRUDE 8675 BPSD
PLUS CONDENSATE
500
NAPHTHA HYDROTREATING
NAPHTHA 4500 BPSD
H_2
600
DISTILLATE HYDROTREATING
H_2
DISTILLATE UTILITY BOILER FUEL 7750 BPSD
200
CO-PROCESSING
OHIO 800 TPSD
NOS 5/6 COAL
100
COAL PREPARATION
H_2
1100
BOTTOMS FLAKING
FLAKED BOTTOMS TO FBC
1000
SOUR H_2O STRIPPING
H_2S TO SULFUR PLANT
NH_3 TO SALES

TEAM MEMBERS

Ohio Ontario Clean Fuels, Inc.

- Program administration
- Marketing & financial management
- Interface with U.S. DOE, OCDO, other sponsors
- Extensive background in co-processing development
- Utilizing well-qualified subcontractors and consultants

HRI/Hydrocarbon Research, Inc.

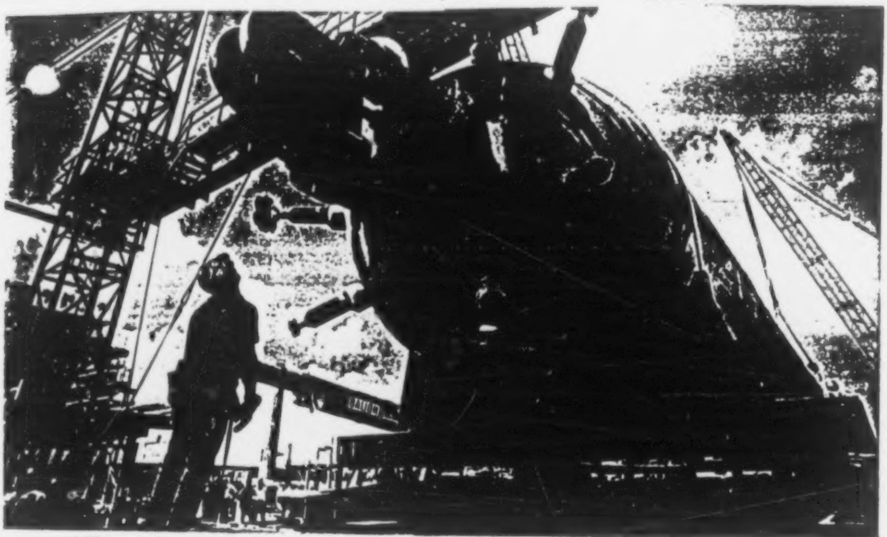
- Inventor of ebullated bed (H-Oil, H-Coal)
- Extensive relevant experience, including Catlettsburg H-Coal
- Current DOE contract (U.S. $5MM) on coal liquefaction
- Process development units — expertise, experience
- HRI will manage process design and demonstration

Stearns Catalytic Corporation

- World-class engineering and construction firm
- Manager of Willsonville coal liquefaction facility
- Many government-sponsored (demo program) contracts
- SC will assume overall project management for OOCF
- SC will follow project through construction and operation

PROGRAM TO COMMERCIALIZATION

	$U.S.
1. Where we are:	
- Completed 4 years of development work	
- Completed 2 years of piloting and feasibility studies (March 1986)	
Expenditures	$3.500 MM
2. Where are we going:	
- Complete piloting, late 1986	0.875 MM
- PDU and feasibility 1987	20.000 MM
	24.375 MM
3. Commitment late 1987:	200.000 MM
Total project	224.375 MM



H-Oil reactor being installed at Texaco U.S.A.'s Convent refinery is one of four units which will enable the plant to process a slate of 100% high sulfur crude. The reactor is 122 ft long and weighs 880 tons

Ontario-Ohio Synthetic Fuels Corporation Ltd.

PROJECT SUMMARY

Plant Production:	11,750 barrels per day of naphtha and distillates 530 Barrels per day of propane and butane 57 tons per day sulfur 14 tons per day of ammonia
Plant Site:	Ohio (near coal supply facilities and fuel and natural gas pipelines)
Feedstocks:	High sulfur/nitrogen coal blended with poor quality petroleum residual oil (design feedstocks:- Ohio # 5/6 bituminous coal; Cold Lake Canadian atmospheric residual oil)
Technology:	HRI's ebullated bed co-processing

PRODUCT CHARACTERIZATION

OVERVIEW OF CO-PROCESSING PRODUCTS

Co-Processing Product	Nominal Boiling Range	Probable Disposition	Possible Further Up
Naphtha	IBP-390°F	Gasoline	Hydrotreating and Catalytic Reform
Mid-Distillates	390-500°F 500-650°F	Jet Fuel Diesel Fuel No. 2 Fuel Oil Turbine Fuel* No. 6 Fuel Oil	Hydrotreating
Vacuum Gas Oils	650-850°F 850-975°F	Conversion No. 6 Fuel Oil Turbine Fuel* Recycle to Reactor	Hydrotreating, Fluid Catalytic Cra Hydrocracking
Resid (Excluding Solids)	975°F+	No. 6 Fuel Oil Recycle to Reactor	
Resid (Including Solids)	975°F+	Partial Oxidation Direct Combustion Solids Separation Recycle to Reactor	Flaking, Fluid Cokir

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*Including oil-fired combined cycle electric power generation.

PROJECT SCHEDULE

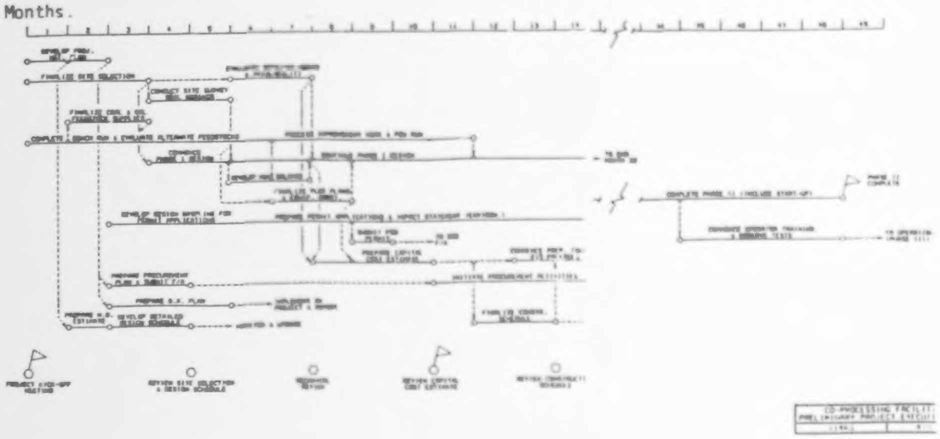
Phase one: Design & permitting (August 1986 - December 1988)

- Co-processing unit design/process demonstration
- Detailed plant engineering design
- Environmental impact statement/permitting

Phase two: Construction and startup (August 1987 - August 1990)

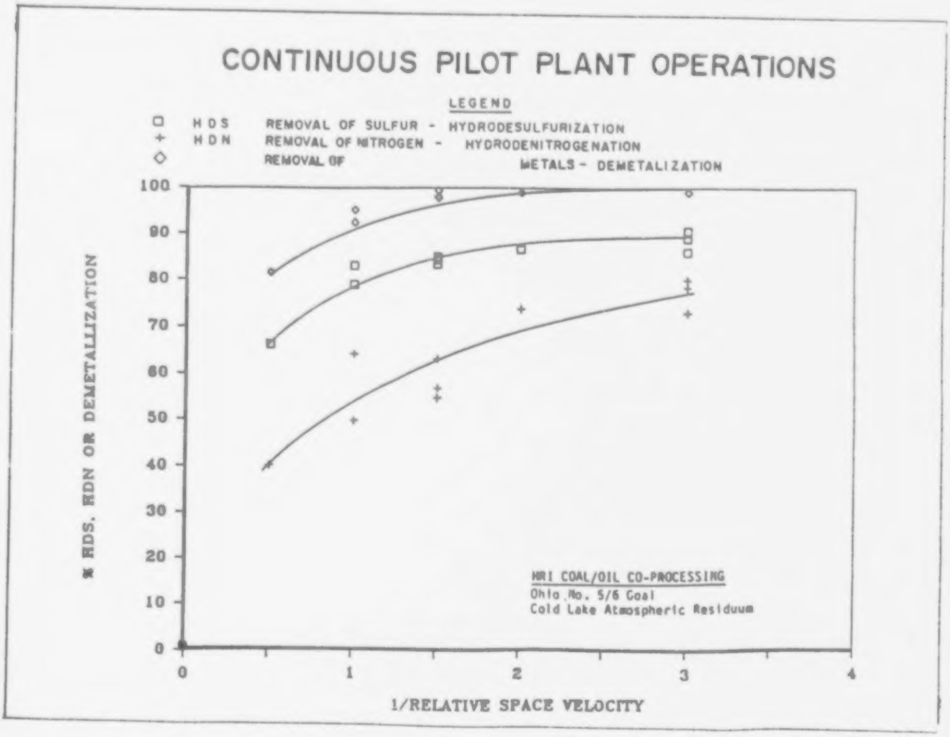
- Equipment procurement
- Construction/Inspection/Testing
- Start-up 1990
- Plant acceptance 1990

Phase three: Plant operations (on-going from 1990)


Months.
FINALIZE SITE SELECTION
COMPLETE PHASE II (INCLUDE START-UP)
PHASE II COMPLETE
INITIATE PROCUREMENT ACTIVITIES
CO-PROCESSING FACILITY
PRELIMINARY PROJECT EXECUTI

PRODUCT QUALITIES

Naphtha		
Nominal boiling range	C_5 - 390 °F	
Gravity, °API		61.0
Sulfur, Wppm	<1	
Nitrogen, Wppm	<1	
Distillate Utility Turbine Fuel		
Nominal boiling range	390 - 975 °F	
Gravity, °API		23.5
Sulfur, Wppm	0.20	
Nitrogen, Wppm	0.20	



CONTINUOUS PILOT PLANT OPERATIONS

Feedstocks: Ohio # 5/6 coal
Cold Lake Atmospheric Bitumen

Bench Run No.	1	2
Condition No.	2	4
No. Stages	1	2
Wt% coal in fresh feed	33	50
Process performance, wt% MAF		
975°F conversion	75	90
C_4-975°F liquid yield	67	78
Coal Conversion	93	96
Hydrdesulfurization	83	86
Hydrdenitrogenation	64	80
Demetallization	95	99

The product costs in the economic section are for the bench run #1 above, which is a one reactor process (single stage) configuration. Superior process performace was obtained in bench run #2.

ECONOMIC FACTORS

In terms of economics, the proposed project:

* Requires less capital investment, about 50% less per barrel of capacity than frontier, tar sand, enhanced heavy oil or shale oil projects.

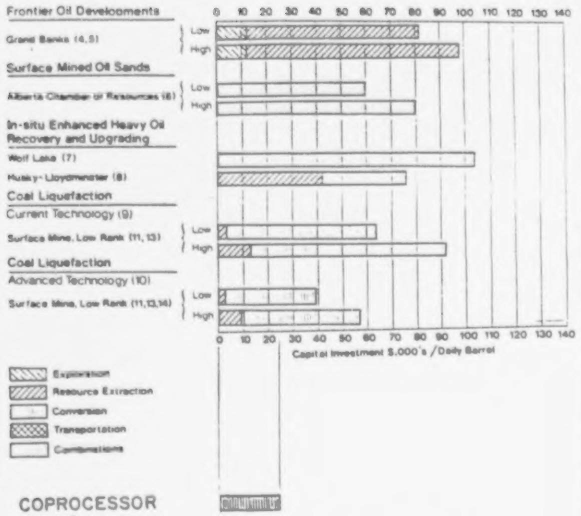
* costs of co-processing are more than competitive with the costs of resid upgrading, a process for production of clean fuels. The reason is that due to the low cost of coal, the coal/resid blend to the co-processor is significantly lower cost than the resid to an upgrader. Besides this econonic advantage there are technical benefits.

* It is possible to maintain margins when energy prices decline generally. The reason is that as high quality low sulfur fuels decline, our products, our feedstock costs, coal, natural gas and high sulfur residual oil decline accordingly.

* Yields of high quality products exceed 90%, there is no low value high sulfur coke produced for instance.

* The plant is being placed at a confluence of low cost feedstocks which can be delivered by means of existing delivery systems and in existing infrastructure and in the market place.

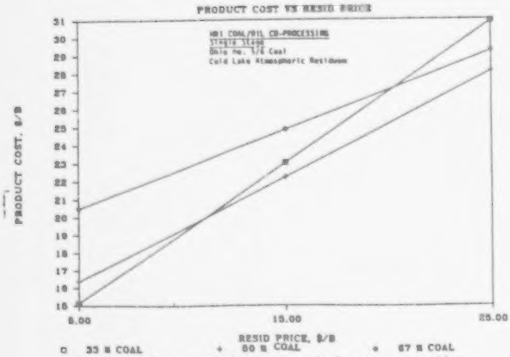
* The plant is modular allowing for maximum bidding and financial arrangement and efficient shop construction.



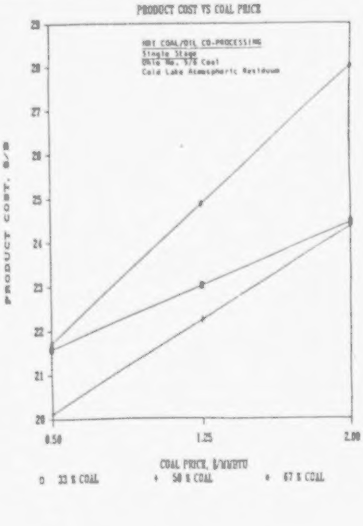
Superimposed on
original by
R.H. Shannon.

REF EMR CANADA 1985

Capital Investment to Produce
Refinery Feedstocks for Alternative
Canadian Energy Sources



These results as noted are on a single stage operation. The two stage operations provided.....superior process performance and product quality....greater selectivity for higher value products and correspondingly less gas oil....greater removal of sulfur, nitrogen and metals. The results of the two stage operation indicate higher value for the products.........without a corresponding increase in cost.



MAJOR REASONS FOR THIS PROJECT

There are two major reasons for plants to produce clean fuels from high sulfur coals and residual oils.

One is to be able to use the extensive high sulfur coal and heavy oil reserves of North America for energy purposes without producing more acid rain.

The other is to use such reserves to replace the declining supplies of light clean oils for purposes such as transportation.

THE ACID RAIN FACTOR

What is acidic rain?
Natural rain is slightly acidic. It dissolves atmospheric carbon dioxide to form weak carbonic acid. Rain is also affected by natural air pollution from volcanos, sea spray and blowing soil.

However, acid rain is frequently much more acidic than normal because of sulfur and nitrogen oxide pollution.

How is acidity measured?
The acid level of a solution is measured in pH units on a scale from 0 to 14. The lower the number the more acidic the solution. A pH of 7.0 is neutral, neither acidic nor alkaline. A decrease of one unit represents a ten-fold change in the acids content. For example , a lake that measures a pH of 6.0 contains ten times more acid than a lake with pH of 7.0. Pure water, in equilibrium with carbon dioxide in the atmosphere has a pH of about 5.6. Therefore 5.6 is regarded as the value which rainfall will have in the absence of other chemical influences.

The effects of acid rain, caused by burning high sulfur fuels have received considerable attention recently. Less attention during this period of low oil prices is given to the fact that North America is drawing down its light oil reserves at nearly double the "find" rate of such crude oil in North America. North American imports are climbing again, a heavy dependence on OPEC sources is a near certainty by the end of the decade

COAL CLEANING AND SCRUBBING

We will deal only briefly with the acid rain aspect due to the attention it is receiving. Efforts to reduce sulfur and nitrogen emissions involve methods to "deep" clean coal before combustion or to treat such compounds during or after combustion. None of these approaches are effective in removing all sulfur or the major nitrogen compounds.

"Deep" cleaning of coal before combustion only removes about 50% or in some case slightly more of the sulfur. No nitrogen is removed by "deep" cleaning. The rejected fines containing the sulfur that was removed have high levels of sulfur. Sulfur is therefore is still emitted by the combustion process and by the waste, and all nitrogen enters the environment.

Scrubbers, the classical method of removing sulfur, result in the production of large waste ponds. They do not remove nitrogen.

The system which has been under development since the late 70's by Ontario Ohio Synthetic Fuels, and now conclusively demonstrated removes virtually all of the nitrogen and sulfur from high sulfur coals and residual oils and recovers them as valuable by-products elemental sulfur and ammonia..useful fertilizer and industrial products.

Drew Lewis, the US Envoy in referring to measures which can be taken to reduce acid rain referred to the "high socio-economic cost"of such measures. He had in mind the two conventional solutions. The first substitutes low sulfur, high nitrogen western coal for high sulfur high nitrogen eastern coal. This solution pits the jobs of western miners against those of eastern miners. It should be noted that this "socio-economic" solution by which eastern miners are unemployed still does nothing for nitrogen removal. Western coals are as high in nitrogen compounds, precursors of acid rain as eastern coals.

The solution as proposed by Ontario Ohio Clean Fuels Inc, provides a clean energy from eastern coals and does not result in eastern miners being unemployed, quite the reverse.

The 1983 US-Canada Memorandum of Intent 3B reported the following as the emissions in 1980.

Man Made Sources of SO_2 and NO_2. (Million tons)

	Sulfur emissions (SO_2)	Nitrogen emissions.
US	24.1	19.3
Canada	4.8	1.83
	28.9	21.13

A recent report to EPA by ICF indicates that nitrogen emissions by the year 2000 will be greater than sulfur emissions.

The 30% Club. Environment Ministers from Canada and nine European countries met in Ottawa on March 20 and 21, 1984, and signed an acid rain accord pledging to reduce annual sulfur dioxide emissions by at least 30% by 1993. The declaration also promises to decrease nitrogen emissions.

DECLINING OIL SUPPLIES

We would now like to provide background on the other aspect of using high sulfur coals to produce light clean fuels. That is to replenish the declining supplies of light crudes in North America.

Canada is the major source of oil for the U.S.A. i.e January 1986,

Canada	826,000 barrels per day,
Mexico	680,000 " " "
Saudia Arabia	664,000 " " "

These three sources represent nearly one half of the US imports. The US relies on imports to supply about 30% of it's requirements.

Canada is also the world's leading producer of upgraded clean fuel oils from non-conventional hydrocarbons.

Canada	150,000 barrels per day
South Africa	90,000 " " "
U.S.A. Union shale	10,000 " " "

These sources, such as the bitumen or pitch from tar sands or enhanced heavy oil non-conventional production operations have undesirably high sulfur and high nitrogen levels. In the case of Canada due to the decline of light oil production from conventional sources, production from non-conventional sources will have to double from 150,000 to 300,000 barrels per day by 1995 to simply maintain overall current levels of oil supply to Chicago and other refiners. This level of expansion will not happen. Canada does not have the capability to continue to supply the above amounts of conventional oil to the US nor the capability to expand non-conventional production to the required 300,000 barrels per day to take up the slack. Neither do the other US suppliers, Mexico, Venezuela, and the fields in the North Sea.

North America will have to rely more and more on production of oil from non-conventional hydrocarbon materials which have high sulfur and nitrogen levels if it is to meet its future low sulfur low nitrogen fuel oil requirements. The U.S will have to develop sources which it cannot obtain from Canada, Mexico, Venezuela, the North Slope and the North Sea.

New supplies for North America can be from coal and the tar sand heavy oil reserves. This is the result of a modification to the technologies currently used for production of non-conventional supplies. This modification been demonstrated in programs initiated by Ontario-Ohio Synfuels Corporation Inc. its Ohio affiliate, Ohio Ontario Clean Fuels Incorporated. Its co-sponsors are the State of Ohio, and the Electric Power Research Institute, (EPRI), the research arm of the U.S. utility industry the Alberta Research Council and Dynaelectron parent of HRI Inc. a specialist firm in hydrogenation of coals and heavy oils.

North America is using up more light crude oil from which clean fuels are derived each year than is being found and this has been the case for 15 years. The continent is very vulnerable to another "Middle East" crisis by the end of this decade four years away.

Declines in oil reserves are being experienced by all of the most dependable and friendly suppliers to the U.S.A.. Along with Canada all other sources have levelled; Mexico is at 3 MM BPD the North Slope at 1.7 MM BPD and the North Sea at 3.7 MM BPD.

The North Sea is expected to enter its decline phase within one or two years as U.K. production starts falling off. North Slope production is forecast by Alaskan state government to start declining in 1990. Only Mexico is expected to raise its output somewhat further over the next five or six years but much of the increase is likely to be consumed internally.

Thus the impact of maximum production from these three major suppliers of light oil to the U.S. has now been fully absorbed by OPEC. Some production increases can be expected from Egypt, Brazil, India and West Africa but there is nothing in sight which would compare even remotely with the developments of the 1970's. in the development of new conventional supplies.

Governments recognize their vulnerability to their domestic declining light oil supplies and the prospect of rapidly escalating prices towards the end of the decade. With large hydrocarbon resources in North America, but with high sulfur and nitrogen levels attention has been directed to cost efficient methods of recovery and processing.

Governments also recognize that such developments are large job creators.

Recent Senate and Congressional committee reviews of synfuels recognize these factors and have directed efforts to small scale plants which demonstrate new technology rather than the huge mega-projects in western North America where huge amounts went into offsites and infrastructures with only a small portion of the costs into the necessary units to demonstrate new technology.

In short there is a new case to be made for upgrading high sulfur/nitrogen hydrocarbons.

Although coal represents 90% of all domestic U.S. energy reserves, it supplies only 20% of the U.S. energy demand, and of this, 80% is for power generation. Obviously, coal should make up a greater portion of the overall energy supply. The reasons it does not are the high cost of transportation, high levels of nitrogen and sulfur, and in many cases, high levels of oxygen, water and ash. coal cleaning, combustion or post-combustion approaches to provide suitable site for clean combustion are generally not available as explained above.

Conversion of coal to liquids overcomes these problems and the coal/oil co-processing provides the most economic and commercially-ready approach to liquids from coal. The basic technology for producing liquids from coal has been developed in major programs supported by various major governments. The technology of coal/oil co-processing has been demonstrated successfully in pilot plants over the past two years.

The application of this technology can provide utilities and refiners with clean fuels from dirty coals and oils.

Total Productive Capacity Of Alberta's Crude Oil And Equivalent: - Figure 4.1

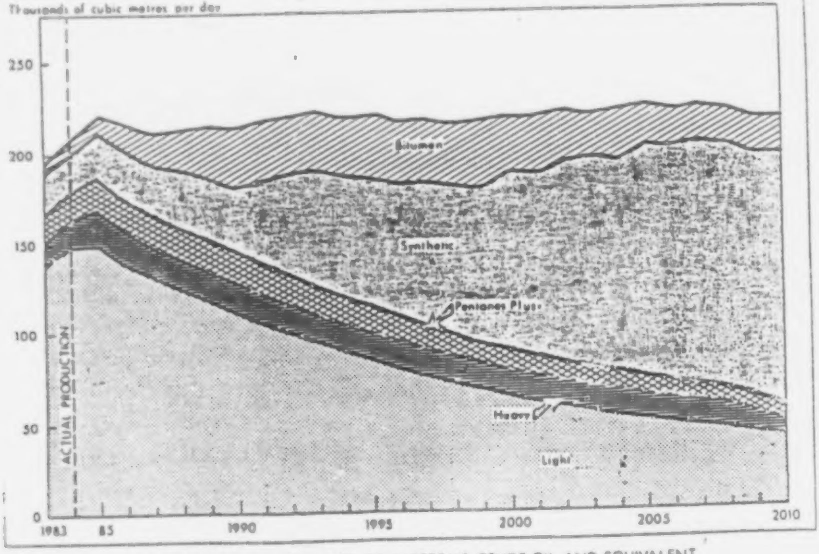


FIGURE 4.1 TOTAL PRODUCTIVE CAPACITY OF ALBERTA'S CRUDE OIL AND EQUIVALENT
All products 1983 - 2010

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Ohio Ontario Clean Fuels, Inc.

TESTIMONY OF R.H. SHANNON, PRESIDENT.

TO THE CONGRESSIONAL COMMITTEE ON SCIENCE & TECHNOLOGY,

SUB COMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS.

ON SEPTEMBER 11th, 1986.

Synergy in Energy
(416) 236-2359

Ohio Ontario Clean Fuels, Inc.

Comparative Economic Analysis of Coal/Oil Co-Processing with Coal Liquefaction; (EOR) in-situ enhanced heavy oil recovery and upgrading; new off-shore frontier operations; tar sand sources and shale.

Despite the current "oil glut" in todays's market place, it is generally recognized that North America will have to rely more and more on oil from domestic non-conventional hydrocarbon sources if it is to meet its future needs for "sweet" or clean fuels and avoid increasing dependence on OPEC.

Clean liquid fuels from coal for power generation by combined cycle, or conversion of older coal burning plants to oil fired, provide an alternative to utilities to the expensive methods to control sulfur, nitrogen and particulate emissions. This approach provides an option to meet low levels of sulfur, nitrogen and particulate emissions while not creating objectionable waste materials. Such methods incur high operating and maintenance costs and can cause the shut down of non-compliance power plants.

For the past 15 years, North America has been using its supplies of conventional "sweet" crude at a rate nearly double the producing rate.

The residual oils produced when "sweet" crudes are refined are the source of clean liquid fuels used by industry and utilities. Just as refiners become more dependent on imports for light "sweet" crude or clean products, so do industry and utilities. Industry and utilities are looking to clean liquid fuels as one viable operating option for simple control of sulfur and nitrogen emissions.

Although coal represents 90% of all domestic North American energy reserves, it supplies only 20% of demand, and of this 80% is for direct power generation. Coal should make up a greater portion of the overall energy supply. Conversion of high sulfur coal to liquids overcomes the factors which have restrained the growth and use of coal. These factors are high transportation costs, high levels of sulfur and nitrogen and in many cases high levels of oxygen, water and ash.

The economic advantages of coal/oil coprocessing have been compared with coal liquefaction, in-situ enhanced heavy oil recovery and upgrading, new off-shore frontier sources, currently operating tar sand plants and shale operations as sources for clean liquid fuels.

Cost factors of sources such as finding, development, EOR production, delivery, upgrading, new off-shore frontier platform, secondary recovery and ultimate platform abandonment are considered in the comparative analysis.

The cost reductions, as compared to direct coal liquefaction

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include; major capital cost reductions per unit of production due to the use of an externally derived solvent which is simultaneously converted to light oils; higher coal loading in the solvent; higher yields and due to the potential for smaller scale, use of sites which are serviced. Operating costs were also substantially reduced.

The coal/oil coprocessing analysis is based on results obtained in a recently completed coal/oil co-processing program which involved over 400 autoclave tests in four laboratories and four extended/continuous pilot plant runs in two pilot plants. A number of coal and oil combinations were evaluated.

The comparative economic analysis indicates that high sulfur/nitrogen coals and residual oils, simultaneously upgraded, (Co-processed) are an economically attractive source of clean fuels to the above sources on which huge expenditures are being made.

As a consequence an "oil reservoir" of billions of barrels in the heartland of North America is created from an otherwise wasted resource, high sulfur Appalachian and Mid West coal and abundant high sulfur heavy oils. Ohio reserves alone represent a resource potential of 50 billion barrels, three times that of the North Sea, and much greater than nearly all OPEC countries and all NON OPEC suppliers.

The approach makes use of lower grade resources; effectively arrests the decline of domestic "sweet" crude; reduces imports, and creates employment where it is critically required. It also provides a complete solution to the acid rain problem as the sulfur, nitrogen and particulates, which cause acid rain when combusted are virtually all removed and recovered as fertilizer products.

INTRODUCTION.

Canada is the worlds leading produccer of upgraded clean fuels from non-conventional hydrocarbons with daily production of 150,000 barrels followed by South Africa at 90,000, and the US at 10,000.

Due to the decline of conventional crude oil production, Canada embarked upon a program in the 70's of increasing its production from non-conventional sources such as the frontier, tar sands and from the vast heavy oil deposits. To maintain the same level of deliveries of light oils supplies to its historical customers in the Northern tier and to Eastern refineries expansion of non-conventional sources of at least 150,000 barrels per day is now required.

Declines in conventional light oil reserves are being experienced by all of the most dependable and friendly suppliers to the U.S.A. Along with Canada and the U.S.A. all other sources have plateaued or are in decline. Mexico is at 3 MMBPD, the North Slope at 1.7 MMBPD and the North Sea at 3.7 MMBPD.

These countries do not have the new light oil supplies nor the capability to expand non-conventional supplies. Canada has the greatest potential for maintaining current levels of deliveries of Non OPEC oil to the USA. However, it does not have the capability to continue to supply the above amounts of conventional oil nor to expand the production of non-conventional sources to the required 300,000 barrels per day in spite of substantial government incentives.

Canadian government incentives to the industry have totalled more than $ 10 billion in the past 10 years and not one new source has been developed. One tar sand plant is being expanded by 29,000 bbls/day.
The North Sea is expected to enter its decline phase within one or two years. North Slope production is forecast to start declining in 1990, in spite of enormous expenditures for new sources such as the dry Mukluk hole. Only Mexico is expected to raise its output somewhwat further over the next five or six years but much of the increase is likely to be consumed internally.

There is nothing in sight which would compare remotely with the developments of the 1970's in the development of new supplies.

During the examination of the complexity and costs of production from the vast heavy oil deposits, it was apparent that the addition of low cost coal to the heavy oil before upgrading would average down the overall cost of heavy oil presented to an upgrader and effectively extend the reserve base and result in production of more "sweet" oil than if reliance was entirely on heavy oil reserves.

Heavy oil recovered by enhanced methods is expensive. Costs generally run at least $ 11 U.S. per barrel in Canada, Venezuela and California. These costs are increased to about $ 20 per barrel delivered to Chicago due to cost of diluent and extra pipeline tariffs due to the viscosity.

Coal in the Appalachian region and Mid west of the USA, cleaned and delivered to likely sites for upgrading such as refineries which were processing the heavy oil for asphalt averages about $ 35 per ton.

The two years of piloting demonstrated recovery of 5.1 barrels of C3 plus from coal which represents a cost in terms of contained oil of $6.86 per barrel.

COMPARATIVE ECONOMIC ANALYSIS OF NEW OIL SUPPLIES: US $
AS SPENT $, 1986, NO ESC ON SUNK FRONTIER COSTS, BASIS GREAT LAKES DELIVERY SEPT, 1986

		WEST N.A. CONVENTIONAL	OFF-SHORE FRONTIER NORTH SLOPE	BEAU-FORT	HIBERNIA	TAR SAND MINING UPGRADING	HEAVY OIL ENHANCED RECOVERY UPGRADING	COAL-OIL COPROCESS-ING	COAL LIQUE-FACTION	SHALE
1.	FINDING COSTS	5,96 (13)	9.00	6.33	6.33 (15)	0	0-8 (12)	0.10 (4)		
2.	FEEDSTOCKS	0				0	0	11.35 (17)	14.42	
3.	OPERATING									
4.	MINING									
5.	EXTRACTION									
6.	PRODUCING COSTS	2.43 (1)				9.00 (10)	7.84			
7.	PLATFORM COSTS		7.50	7.50	7.50 (2)					
8.	OTHER - I.E. R & D/MAINT.									
9.	FEED & OPERATING COST FOB FIELD									
10,	UPGRADING	0			0	6.68	3.83	4.62 (7)	12.42	
11.	COSTS-CRUDE/SYNCRUDE FOR FIELD	8.39	16.50	13.83	13.83	15.68	11.67	16.07	26.84	30.20
12.	TRANSIT - FIELD - GREAT LAKES									
13.	REFINING TO PRODUCTS									
14.	OP. COSTS REFINED PRODUCTS.	11.87	29.70	23.83	20.27	19.87	16.88	16.07	30.09	33.70
15.	ROYALTIES									
16.	BY-PRODUCTS - CREDIT									
17.	SECONDARY RECOVERY ENVIRONMENTAL CONTROL ABANDONMENT COSTS									
18.	CAPITAL CHARGE	2.00			8.00	17.28	11.00	6.20	21.80	25.80
19.	FULL COSTS REFINED PRODUCTS	19.66	34.70	28.83	33.27	40.25	28.73	22.43	43.34 (14)	60.00 (16)

The small # in brackets
refer to personal data.

Ohio Ontario Clean Fuels, Inc.
R.H. SHANNON (416) 236 2359

Ohio Ontario Clean Fuels, Inc.

NOTES.

Sept/86
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1. FINDING COSTS.

Conventional Oil.

Salamon Bros and EIA report $ 9.50 OGJ, October 14/85. Arthur Anderson & Co, for 1984 for 400 companies, "cost of reserve additions, during 1980/82 were $ 9.52/bbl for foreign operations compared to $ 14.19 in the US", reports P. Dodge of Donaldson Lufkin Jenrette of NY in OGJ Nov 12/84.

Dodge continues; For 1982, per barrel finding costs, excluding revsions were.. Chevron to $ 20.11 /bbl, Exxon $ 17.81, Mobil $17.44, Texaco $ 19.13

Toalster, Craven of Hoare Govett U.K, August 1984, for 12 major companies over 6 years, costs range from $ 4.38 for Exxon to $ 52.61 for Sohio, average was $13.89.

J. Dyer, VP Texas Commerce Bank, reports "finding costs" of 17 merger and acquisitions seems to be in the order of $ 9 to $ 10". OGJ, Dec 19/83.

"Media company finding and acquisition costs were $ 8.92 of oil equivalent, one quarter of the companies had a cost greater than $13.35, one quarter had costs less than $ 5.15". "The media industry price to purchase reserves was $ 5.60/BOE, compared to $ 6.30/BOE through development drilling and $ 41.05/BOE for exploration". David Ross, Camp Ross, Santoski, Houston, OGJ April 7/86

J. F. Bookout, President, Shell Oil reported Finding and Development costs of $ 13/bbl during period 1982/85.

For the comparative analysis we have use a "finding" cost which is on the low range of the various analysis.

Off Shore-Frontier.

Government and Industry expenditures in Hibernia and Artic, divided by reserves, testimony to National Energy Board of Canada.

Tar Sand & Heavy Oil.

Costs insignificant, extensive reserves of tar sands and heavy oils in the USA, Canada, Venezuela and Mexico have been known for decades.

Coal-Oil Coprocessing.

Cost of $ 0.10 cents per barrel is cost to acquire lease and permit for production of 65 million tons of proven coal reserves. This coal when blended into a heavy oil, has consistently produced 5 barrels of oil per ton of coal on a moisture and ash free basis.

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This equates to a 300 million barrel crude oil reservoir.

Coal Liquefaction and Shale.

Costs insignificant, extensive reserves known for decades.

2. FEEDSTOCKS.

Coal-Oil Coprocessing and Coal Liquefaction operations purchase feedstocks. These costs are for August/September 1986. There is no comparable cost for an oil company once oil has been "found".

3, 4, 5, Proprietary data.

6. PRODUCING COSTS.

Costs of crude oil in case of conventional oil, cost of bitumen extracted from tar sands, or heavy oil oil recovered by enhanced recovery methods and delivered to an integrated processing plant.

7. PLATFORM COSTS.

Based on platform costs estimates for new production in Beaufort, for zero return and platform costs in Hibernia, and reconciled with cost of recent platform costs in North Sea.

For Beaufort, L. Cox, Parsons Engineering, OGJ March 31/86.

For Hibernia, application by Mobil to Cdn authorities, $ 465 million operating costs for 65 million bbls/ yr, is $ 7.15, in todays dollars.

For North Sea, Balmoral field operating costs $ 45 million per year for $ 9 /bbl, for South Brae field operating costs estimated at $ 305 million at 85,000 b/d for $ 11.80 per barrel.

Petroleum Economist Jan 1986 states that Total Costs for Medium cost old field (i.e $20,000 capital cost per daily barrel of capacity at plateau levels is $ 10.20 per barrel at 1983 prices. This is regarded as typical of "old" field conditions.

10. UPGRADING COSTS.

Costs are for conversion of bitumen in tar sand case, for heavy oil in that case and for upgrading/conversion of the coal/oil slurry to light products and for conversion of coal to liquids in coal liquefaction.

Shale operating costs were deduced as the Union Shale unit may not be representative of future plants. The figure was arrived at by using the SFC guaranteed price sof $ 60 per barrel, less capital costs and refining costs to bring them to equivalent products from a refinery operating on crude oil.

14. OPERATING COSTS REFINED PRODUCTS.

Costs to process crude oil; upgraded bitumen/heavy oil; coal/oil, coal liquefaction and shale derived liquids to refined products in refiner distribution systems on Great Lakes.

17. SECONDARY RECOVERY, ENVIRONMENTAL CONTROL, ABANDONMENT COSTS.

Each system has vastly different costs, in each case a minimium cost was taken, to reflect consideration of these items but not to alter the general relationships as a consequence of this factor.

For instance,

Secondary recovery;

Conventional secondary methods and costs are established and not substantial as compared to the high costs now facing off shore operations in the North Sea. Due to the high capital costs of the initial installations, high secondary recovery costs are warranted to deplete the field, and in some case are required to arrest subsidence of the ocean floor.

Secondary recovery operations are not undertaken in the other cases.

Environmental control costs.

Conventional and off shore methods are established and not costly.

In the case of tar sand operations vast quantities of water are required and must be ponded after use. An amount equal to about 20% of daily oil production is rejected as high sulfur coke which must be contained for all time. An alternate is to gasify the rejected coke which will require capital intensive plants and the product would be low valued gas which is not economically viable.

The same may apply to heavy oil operations, except that new plants under consideration will not be allowed to reject useless coke. The method considered is to use more hydrogen initially so that sulfur is reduced in the coke and the coke then may be burned or used industrially.

In coal/oil coprocessing due to the technical features of the reaction very little waste material is produced. In the Ohio plant it will be used in a special boiler for steam production so that the only waste is a small volume of insoluble slag, about 5% of over all production. The unreacted fraction is therefore used as a fuel and no cost is incurred in its disposal.

Environmental control of coal mines in Ohio is well established and not costly, mines are restored to a natural state. Costs are reflected in the purchased price of coal to the coal/oil coprocessing unit.

We have used only nominal values in each case to note the existence of such costs. The value is so small as to not affect the relationships although a full analysis of specific cases could effect the relationships.

Abandonment.

The abandonmnet of a coal/oil coprocessing plant would be compared to the costs of abandonment of a refinery. It would be cannabolized for some equipment and the balance sold as scrap.

This is not the case in some of the other alternate sources. In the North Sea, abandonment costs are just now being considered. The abandonment of huge platforms by toppling or dismantling can be an expensive undertaking. A method favored in the North Sea in deep water is to topple the units with explosive devices leaving the debris on the ocean floor. This cheapest method is expected to cost $ 5.5 billion. Concerns have been expressed that such metal structures could be safe havens from detection for Soviet subs, and risks of collision for submarines friendly or otherwise. Removal is estimated to cost $ 12 billion.

A draft of the International Law of the Sea Agreement in 1982 proposed that all platforms be removed completely and the sea bed restored, this obviously is not the case in the cheapest approach. This approach would cost $ 12 billion.

There is an additional cost for removing the eight massive concrete fixed platforms in the North Sea which are among the largest structures made by man. Cost to remove are estimated at $1.8 billion. The effects of moving are not known concerns of a "champagne cork" effect are expressed.

The point in noting these matters in the North Sea is that they are intensified in the Northern Atlantic Hibernia and Artic Beaufort fields.

18. CAPITAL CHARGE.

For consistency an .1102% mortgage rate was used on all capital which was divided by annual production. This was a method used by some government agencies as a method of comparing the social cost of new oil production from various sources. We find it an adequate method to present a comparative capital charge. High rates are normally used by industry but this would not affect the relationships.

OHIO DEPARTMENT OF DEVELOPMENT

Please reply to: Ohio Coal [illegible]
65 E. State St., Suite [illegible]
Columbus, Ohio 43215
(614) 466-3465

Richard F. Celeste, Governor
Clarence D. Pawlicki, Director

April 7, 1986

Mr. Robert H. Shannon, President
Ohio Ontario Clean Fuels, Inc.
2540 Jennifer Dr.
Poland, Ohio 44514

Re: Proposal No. D-86-059 01-US

Dear Mr. Shannon:

The State of Ohio has a sincere interest in advancing the development and application of clean coal technologies. I was, therefore, particularly pleased to receive your proposal that would build upon our previous support of your coal co-processing and result in a prototype commercial plant near Warren, Ohio.

This letter serves as a preliminary expression of interest by the Ohio Coal Development Office to be a financial co-sponsor of this project in an amount up to $10 million. This commitment of support is contingent upon the acceptance of a complete application, the recommendation of the Office's Technical Advisory Committee and the approval of the Director of Development. Further, the award of Ohio Coal Development Office funds shall be contingent upon the commitment of U.S. DOE - Clean Coal Technology Program funds to this project.

I look forward to our continuing association and the completion of a prototype commercial co-processing plant near Warren, Ohio.

Sincerely,

David A. Berger

David A. Berger, Director
Ohio Coal Development Office

DAB:dlp

New York State
Energy Research and Development Authority
Two Rockefeller Plaza • Albany, New York 12223
(518) 465-6251

March 10, 1986

Mr. Robert H. Shannon
Ohio-Ontario Clean Fuels, Inc.
2540 Jennifer Drive
Poland, Ohio 44514

Dear Mr. Shannon:

The Hydrocarbon Research, Inc. (HRI), Two-Stage Co-Processing technology seems to be approaching several very major milestones in its development: demonstration of the process and commercial venturing. From the data and information provided by Ohio-Ontario Clean Fuels, Inc. (OCF) and HRI, it appears as though the co-processing approach can significantly reduce capital requirements and provide a wide range of fuel qualities. Such potential makes this technology and the fuels produced of particular interest to the State of New York.

In the short time since OCF introduced the HRI co-processing technology to prospective fuel users in this State, there has been a growing interest by various State government, industry and utility entities to learn more about the technology and how it might serve their needs. As a result, there now appears to be some chance for a consortium of State government and industry groups to conduct a "scoping study" with OCF to further assess the prospects of the Two-Stage Co-Processing technology. The Energy Authority understands that a similar effort is underway in the State of Ohio. If this effort proves favorable, then such a plant would serve several important purposes from New York's perspective. First, the demonstration of the co-processing technology, and second, the production of sizeable fuel quantities for testing and use in the New York State market.

Please keep us apprised of your activities and progress in Ohio. If this venture is successful, and if the New York State scoping study warrants, then perhaps a similar venture may become possible in New York. This prospect would boost local economy and help the State achieve its objective for fuel diversification and foreign oil backout.

Sincerely,

David J. Boron
Senior Project Manager

DB15/nb

GEORGE E. EVANS, JR.
SECRETARY

MARTHA LAYNE COLLINS
GOVERNOR

KENTUCKY ENERGY CABINET

July 21, 1986

Mr. B. Stephen Logan
Department of Energy
Office of Procurement Operations
Contract Operations Div. A [MA-452.1]
1000 Independence Ave. SW
Washington D.C. 20585

Dear Mr. Logan:

Subject: Ohio Ontario Clean Fuels Proposal, PON: DE-PS01-86FE60966

The Kentucky Energy Cabinet has a long history of research and development in coal liquefaction. We were major participants in the H-Coal Pilot Plant Project dating as far back as 1974, and provided considerable support to the commercial-scale Breckinridge Project. We were also involved in the demonstration of SRC-1 from 1976 through 1982. Clearly, we were involved in two of the major coal liquefaction technologies and projects of the times.

As you may be aware, the Commonwealth of Kentucky still maintains a strong effort in coal utilization R&D as evidenced by a state-funded research budget of over $5.5 million per year. Of that, approximately $1.4 million per year is devoted directly to coal conversion and oil shale retorting programs. Over the past five years, most of our research has pertained to catalyst reactivity and solvent quality as related to both single and two stage liquefaction. Just recently, coal has been introduced as part of commissioning our 10 pound per hour prototype integrated process unit in preparation for hydrogenation runs on Kentucky coals. The cost of this unit installed was about $1.4 million.

In a parallel effort, we are a cost-sharing partner in the USDOE Consortium for Fossil Fuel Liquefaction Science. Part of that program will include co-processing oil and coal. We feel that co-processing, for several reasons, is a very promising technique for early commercial application.

The purpose of this letter is to inform you that we would now like very much to focus more of our efforts on the commercial concept being proposed by Ohio Ontario Clean Fuels, Inc. and HRI, Inc. With the hope that such plants as the one proposed for Warren, Ohio can be replicated in Kentucky, using Kentucky coals, we are committing $250,000 worth of our research budget for our fiscal year 1986-87 towards co-processing technology as it pertains to our resource.

The Kentucky Center for Energy Research Laboratory (KCERL), which is our prime research contractor, has identified areas of endeavor which are particularly applicable to the Ohio Ontario technology (attached). At this time we intend to address the first three of these over the coming year. Items four and five will be initiated within the next three years as development proceeds to larger scale.

Obviously the most efficient way to conduct our co-processing activities is in conjunction with the commercial project and in collaboration with Ohio Ontario Clean Fuels, Inc. and the State of Ohio. Preliminary discussions have already been held with these parties and they are in agreement with the idea; it only remains to work out the details.

Needless to say, whether we direct more of our research towards co-processing depends on the Ohio project going forward, which in turn depends upon its selection under the Clean Coal Technology Program of the USDOE. We therefore encourage the Department of Energy to view the project favorably. It is, at least in an indirect way, important to the goals of the Commonwealth of Kentucky and we look forward to participating with the USDOE in coal/oil co-processing development.

Sincerely,

George E. Evans, Jr.

George E. Evans, Jr.

GEEJr:ram
0049f

Attachment

cc: Mr. Robert H. Shannon, OOCF
Mr. David A. Berger, OCDO

KCERL Research Applicable to Ohio-Ontario

1. Catalyst Characterization

Analysis for amount of contaminents deposited during aging, changes in porosity and surface area during aging and distribution profile of deposited elements. Reactivity tests with mixture suitable to evaluate relative catalytic function deactivation.

2. Maceral Separation and Characterization

Coals will be selected and separated to give pure, or highly enriched, maceral fractions. These fractions will be characterized for thermal conversion and for liquefaction solvent response.

3. Waste Stream Characterization

Residue will be separated into soluble and insoluble materials; elemental and compound class and compound composition of soluble organics will be determined.

4. Atmospheric Fluidized Bed Combustion

The combustion characteristics and the characteristics of limestone for trapping, S, N, etc. will be evaluated.

5. Corrosion and Failure Analysis

Corrosion in aqueous and organic phases caused by elements common to coal, e.g., chloride, will be evaluated. Failure analysis for operating plant will be conducted.

[illegible]

STATE OF ILLINOIS
OFFICE OF THE GOVERNOR
SPRINGFIELD 62706

JAMES R. THOMPSON
GOVERNOR

July 7, 1986

Honorable John S. Herrington
Secretary of Energy
U. S. Department of Energy
1000 Independence Avenue, S.W.
Room 7A-257
Washington, D.C. 20585

Dear John:

We have had several discussions over the past year about the importance of the Clean Coal Technology Program to the State of Illinois. I am writing to you now to convey my continued support for the national program and for the proposed Illinois projects. I do so from the view that the Clean Coal Technology Program can be the central component of a major federal policy initiative of great significance to my state and the nation.

The Congress is currently engaged in the consideration of acid rain legislation that would decimate the midwest coal industry. The debate over acid rain has taken on international dimensions with our closest neighbors. Wisconsin and other states have already implemented stringent sulfur dioxide and nitrous oxide emissions standards. The State of Illinois and other eastern coal-producing states face the immediate and critical challenge of finding the technological means to allow power plants to continue using locally available coal. The DOE program offers the most constructive approach to reducing pollutant emissions, while allowing the continued use of our coal and maintaining thousands of jobs in already depressed areas.

Within the context of the national acid rain dilemma, the development of retrofit technologies is particularly important. In response to the Clean Coal Technology Program solicitation, the State of Illinois has joined with the Gas Research Institute of Chicago to provide 50 percent of the funds required by the Energy and Environmental Research Corporation to demonstrate important new technologies for the control of sulfur and nitrous oxide emissions from coal-fired power plants. These new technologies combine natural gas reburning and sorbent injection within the coal-fired boiler to reduce sulfur emissions by 50 to 70 percent and nitrous oxide emissions by 60 percent. The gas reburning and sorbent injection technology can be retrofitted to provide very cost-effective control of emissions from existing boilers without switching to low sulfur coal or installing costly scrubbers. Under our proposal, the technology would be demonstrated in three Illinois power plants. As each of the plants uses one of the three major utility boiler types utilized in the United States, the successful demonstration of this technology could lead to rapid emission reductions in other plants nationwide.

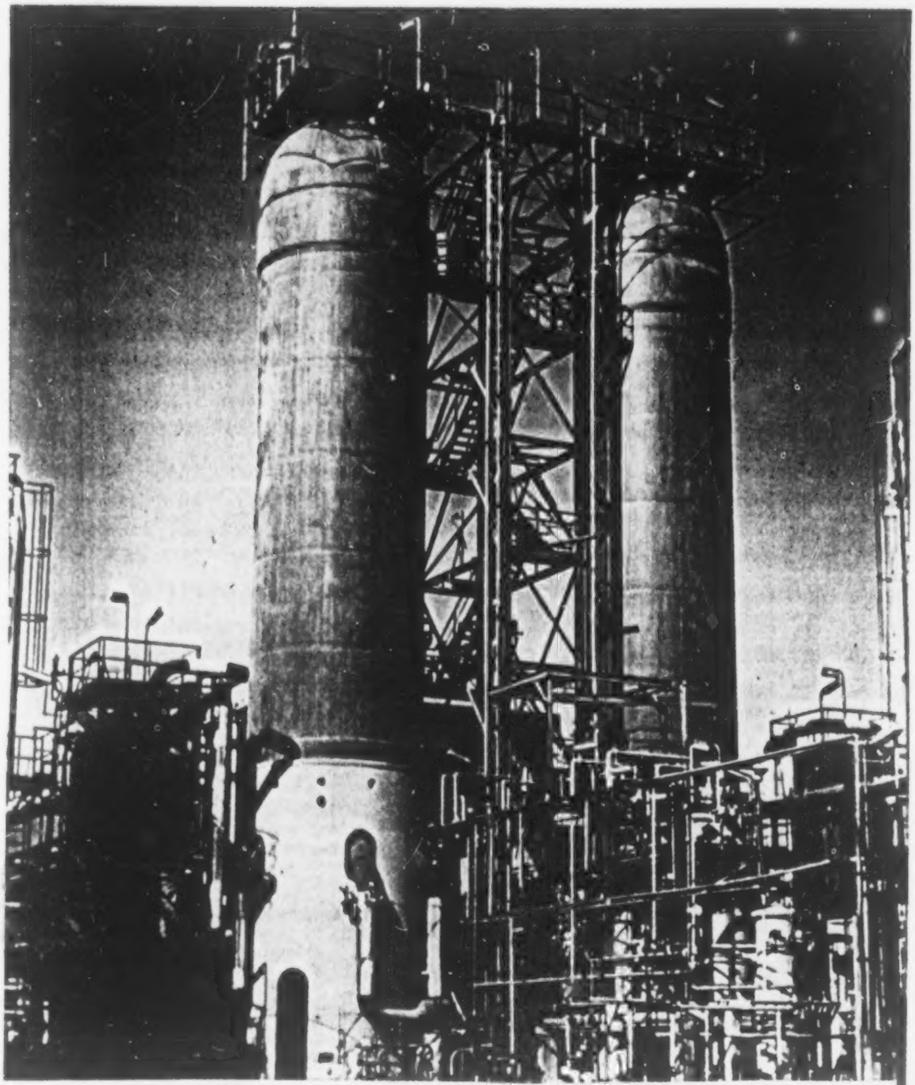
Illinois has also committed one million dollars to the support of a turbocharged pressurized fluidized-bed combustion (PFBC) project, which has been submitted to the Clean Coal Technology Program by a utility/industry group headed by Wisconsin Electric Power Company. The turbocharged PFBC represents a technical option which will comply with environmental performance standards for new plants at substantial savings and will, also, provide a highly desirable alternative for utilities planning to install retrofit technologies in order to extend the life of existing plants. This is the first time that we have ever pledged funds to a demonstration project outside of Illinois in our ten-year history of supporting clean coal technology development, and we have done so because we believe that PFBC technology has particular merit.

The technology demonstration projects that Illinois has committed to support have been carefully selected from a range of potential systems. These important technologies cannot be fully proven in the laboratory or at pilot scale. Full size tests in commercial settings are necessary to validate their technical performance and economic benefits. I hope that DOE will give favorable consideration to sharing in the demonstration of this technology.

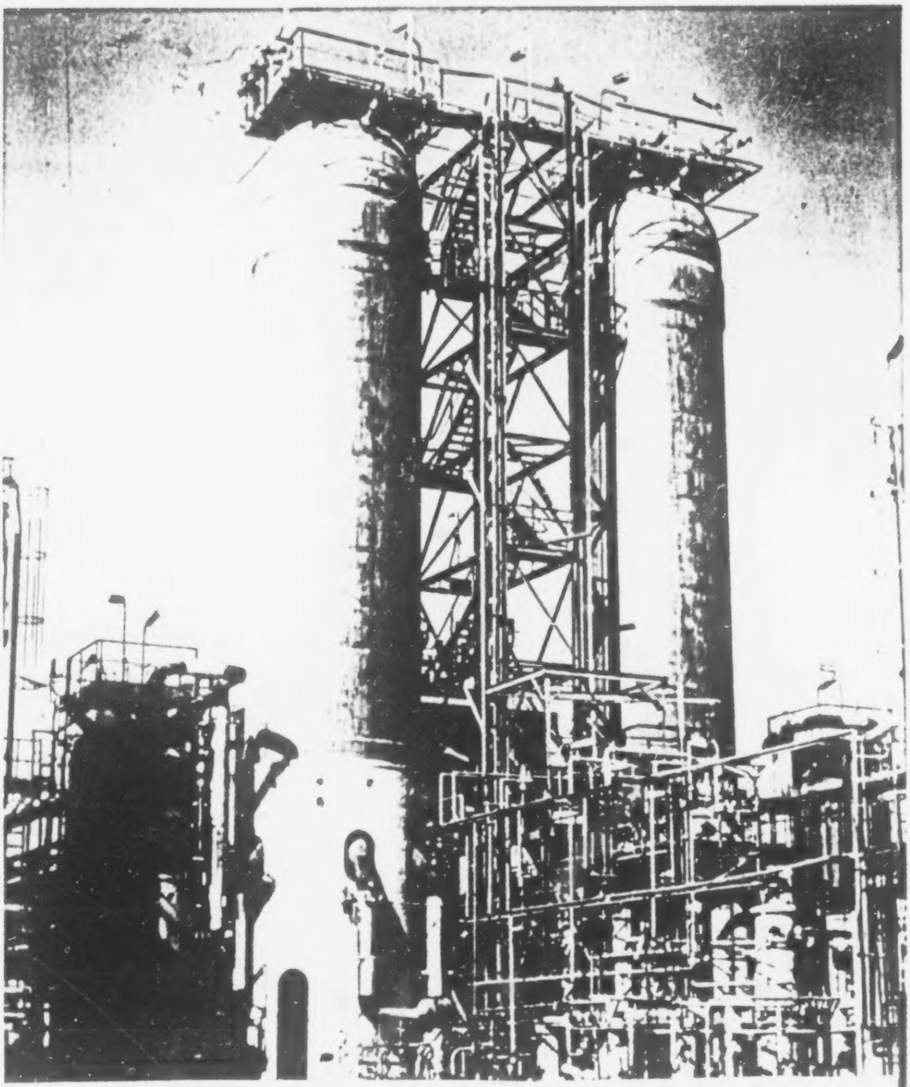
The State of Illinois remains committed to the clean coal approach in dealing with the acid rain issue, and we are very happy to have you as an ally in this important national issue. I assure you that I will continue to provide my earnest support to the DOE program, and I pledge the resources of my state to ensuring its future success. I look forward to having you visit Illinois in the near future to discuss these and other matters of mutual interest.

Sincerely,

James R. Thompson
GOVERNOR



THE HEAVY OIL-COAL SLURRY IS PROCESSED IN PLANTS SUCH AS THIS ONE. THIS PLANT WAS DESIGNED FOR PROCESSING HEAVY HIGH SULFUR OIL ONLY INTO LIGHT CLEAN PRODUCTS. IT HAS BEEN OPERATING FOR 20 YEARS.



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PANEL 2 DISCUSSION

Mr. **Traficant**. I would like to start out by saying that any of the individuals offering testimony here today who have specific letters of agreements or contracts which would amplify or expound upon their specific contract proposals can make copies of them to the committee, and they shall be incorporated with and affixed to your proposal and to the testimony here on record.

I am somewhat familiar with the last piece of testimony and that particular program. I believe it carries on some different connotation from some of the other previously. I would like to begin with some questions there as far as private sector financing, since I am of the impression that Ohio Ontario would—the Department of Energy, the match would be about 20 percent.

Being that this is such a large project per se, in comparison to some of the others that we've heard about today, what is the status of your private financing, and to what degree can you expound upon that, since, if I am not mistaken, we're talking about approximately $150 to $160 million in private financing, Mr. Shannon?

Mr. **Shannon**. We have been working with Japanese and European organizations, and we have a tentative pro forma lease agreement—the Japanese are masters of construction of this type of equipment—and for up to $100 million, on very favorable terms, below U.S. prime.

We have kept Merrill Lynch informed, and Merrill Lynch says we have got to see some Government paper. We've got to see some Government commitment. Government commitment will unlock further private sector funds.

We have been offered sales contracts by several utilities for this product who want to see domestic supply rather than relying on OPEC and offshore oil. We have declined those at the moment because the Ohio officials asked us to work up contracts within Ohio. These other contracts were with New York State.

Mr. **Traficant**. Well, I am somewhat familiar with the position of the Sate of Ohio. Although they haven't formally announced it, I am under the impression that there would be an award coming through their clean coal initiative moneys. It could be in the neighborhood of $10 million.

Mr. **Shannon**. $10 million.

Mr. **Traficant**. Have you had any official notification of that?

Mr. **Shannon**. I was informed that it has passed the Technical Advisory Committee of the Governor yesterday and it's before the director and the Governor for approval, and an announcement could be expected next week and that it is $10 million within the next 12 months.

Mr. **Traficant**. One other point before we move on. A lot of the questions that come from the committee—and certainly the intent of Congress is not just to invest Government dollars into promise but evidently to see that these technologies that offer such great, quote unquote, promise can be converted to commercial application and utilized in existing plants with reasonable retrofit expectations—what specifically would be the commercial application of your technology into existing plants and what type of a timeframe would be involved with that?

Mr. SHANNON. I will answer the last part of the question first. In terms of the time frame, our critical path, developed by one of the country's best engineering firms and HRI, shows early 1990 for startup of the prototype commercial demonstration plant. It would be possible at the end of this run and one more run next year, and the completion of the design next year, that if there was an emergency in terms of energy security or a more stronger approach on acid rain, a real major commitment, other plants besides the prototype demonstration could be locked in right behind them very quickly without awaiting this prototype.

In terms of retrofit, I think the most attractive thing are the old coal-burning plants, which I heard in the testimony yesterday, concern about shutting them down, taking them out of the system, and not having permits for new environmentally acceptable plants. These could—they just have to change the burners here and put in an oil storage tank, and that plant is in compliance.

Mr. Burger of Ohio has said that plants that went on this fuel would actually be buying pollution credits, and those plants could then run out their life with their boilers and so on. At the end of that time, they could go on to what we call the nonintegrated coprocessing combined cycle; that is, put in turbines and run off the same plantsite and the same distribution system.

Mr. TRAFICANT. One of the questions that I have insofar as I believe the prenegotiation contract application would call for $45 million—that can be corrected—in Federal matching moneys. Is that correct: $45 million?

Mr. SHANNON. That was what our proposal was.

Mr. TRAFICANT. OK. One of the concerns would be the recoupment of that particular money over a period of time. What would be your projection on a return that would satisfy this particular loan money, and what do you see as resolving that, and what type of a timeframe would you project that to be?

Mr. SHANNON. The way we've worked it in our economics is that the deal we want is 3 years of demonstration, and we're likely to be demonstrating various coals and not really operating as a commercial entity for 3 years of operation because this would be the prototype. Then we have clicked in repayment of the DOE money on year 4, and it would be repaid as quickly as we could.

Mr. TRAFICANT. All right. Now, if I am to understand your testimony, you say that the nitrogen and the sulfur would not be waste products, they would be recaptured and recycled and there would be a marketing system be put in force where they can be used in applications in agricultural use. Is that correct?

Mr. SHANNON. Yes; the elemental sulfur is converted into sulfuric acid for that type of fertilizer and the nitrogen is converted into ammonia. There's a big market in the Midwest.

Mr. TRAFICANT. One last question. The abatement of this acid rain problem. On demonstration of past performance of your given technology, what is your projection as to the abatement of sulfur emissions in the atmosphere from your process, coprocessing?

Mr. SHANNON. The sulfur, we have removed 90 percent of the sulfur routinely over several years in a variety of operating conditions.

Mr. Traficant. Not to interrupt, but if you have any documentation of data testing relative to that, that can support that particular statement for the committee here?

Mr. Shannon. Yes. We have submitted that statement, that data to Stone and Webster, an engineering firm used by Canadian Occidental, and which was the basis for the overture from Canadian Occidental Petroleum to join us. It's in the DOE proposal, of which we are an awardee. EPRI, it was the basis—the results were the basis for this new contract from EPRI, and it was the basis for the Ohio award.

Mr. Traficant. Would you make a copy of that written statement also to the committee so it could be incorporated into your statement, and also any signed contracts you have, since there is to be such a large emphasis on private sector dollars committed to this project. Any commitments you have also, the committee would like to have to put them into the permanent part of the record.

I would like to move on. Mr. Peace, you seem to be less enthusiastic than perhaps most or anybody that testified regarding long-term benefits of retrofitting plants. Evidently, that's in regards to the technology that you have that you feel on a cost-effective basis over a period of time might be better than to retrofit existing plants. Would you elaborate just a little bit more on how you think that that particular situation and how you feel it would affect the next solicitation, which will probably set aside an additional $350 million for retrofit technologies?

Mr. Peace. Yes; I think that's a good question, Mr. Traficant. What I would suggest in that regard is that the solicitation include some means of evaluating a long-term economic result of a retrofit project; in other words, looking over the life, say, 20 years of the retrofit, what will the power costs from the project be and how will those power costs compare to the new technologies like integrated coal gasification combined cycle plants.

So all I am really arguing for, I think, is some economic and not just environmental looks at the technologies.

Mr. Traficant. That seems to be an age-old struggle before the Congress and many communities. What is the total amount, the dollar cost of your project, total dollar cost?

Mr. Peace. Well, we have not—we have not made public the total amount, but we have talked in terms of dollars per kilowatt. We have told various groups that the dollars per kilowatt cost of the Appalachian project is about $1,900, which is just to calibrate you, about $110 million capital cost of the plant.

Mr. Traficant. And what would be the total Federal share again?

Mr. Peace. We have asked for 50 percent.

Mr. Traficant. Do you have any commitments on your private sector funds for the other financing relative to your prenegotiation developments with DOE?

Mr. Peace. Our proposal indicates that Kellogg, which is our parent company, will be responsible for the 50-percent private cost share. One of our partners in the project is the General Electric Co.

I would just otherwise observe that Kellogg's parent company is the Henley Co., the Henley Group, which is a very large corporation, fully capable of doing this project.

Mr. TRAFICANT. Any specific empirical data or evaluations and/or testings by outside independent sources relative to your technology, Mr. Peace?

Mr. PEACE. Well, we have had an ongoing DOE program for a number of years at Waltz Mill, and we've provided a lot of data to the Department of Energy, which is all in the public domain at this point. DOE and we ourselves have brought in outside consultants and companies to look over what we've done; and to the extent we've proposed projects with others, we always have an overview by that company. So, I think the amount of studying of our technology by ourselves, by the DOE. and by others has been very, very extensive.

Mr. TRAFICANT. Thank you.

Just a couple of brief questions for Mr. Davis and Mr. Horner, again in line with the question that was asked of Mr. Peace and Mr. Shannon relative to any either empirical data or evaluations of your technology and/or assessments or studies that have been conducted by either the Department of Energy or any outside independent sources that would support your particular technology.

Mr. Horner, do you have anything relative to that or you would like to add?

Mr. HORNER. Yes. We have had two programs in time past with the Department of Energy at Morgantown. One was a test program where we tested the concept of hot gas into a gas turbine combustor from a gasifier at our research center. We burned the gas in a combustor, passed it over cascades of air foils, did emissions testings, et cetera. That is a public report.

We have also participated in a systems study looking at various configurations of powerplants burning coal, and this system was looked at recently in comparison to others from the efficiency, emissions, and cost-of-energy viewpoints. That study was just completed in the past few months. I am not sure that it's available in a final report yet, but there are progress reports available through DOE.

Mr. TRAFICANT. What was the total amount of your proposal, the total project costs?

Mr. PEACE. Well, I am not sure we've made that public. But we have offered a program which asks for 50 percent DOE support.

Mr. TRAFICANT. Mr. Davis, relative to any particular studies or assessments or evaluations that you would like to share with us?

Mr. DAVIS. All the technology that we're using in the program is in the public domain to help under cost sharing with the Department of Energy and publish material that has been widely published by our group while we were a part of Gulf Oil. There are numerous studies that have been published reviewing our data at Rawlins and the general technology. It's difficult to cite any specific one, but there was a large amount of data published on this, and it's a matter of public record at various times.

We—our environmental work, which is always an issue raised on connection with our particular technology, has been done under the same requirements and constraints that you would have in a commercial operation, existing requirements in the State of Wyoming, and we've been found to be in full compliance with all those. In fact, the field program, the site that we're operating on with the experimental program, is being abandoned at this point, after meeting all environmental things. But all this is a matter of public record.

Mr. TRAFICANT. The gentleman from Pennsylvania, Mr. Walgren.

Mr. WALGREN [presiding]. Thank you, Mr. Chairman.

The environmental approvals from the Federal Government that you raise, Mr. Peace, synthetic fuels have been cleared. We do not have them cleared in this bill. You expect a lengthy permitting process at this point; is that true?

Mr. PEACE. Excuse me. I think the concern is that once we get into an EIS process, Mr. Chairman, we're faced with, I think, the possibility of a lengthy—lengthy delay. And I think the point really is these are clean technologies with State regulations still in effect, and I am just concerned that we're going to draw these projects out ad infinitum if one intervenor for his or her own reasons chooses to take the thing to court and tie it up for months.

Mr. WALGREN. That might vary from project to project. Some will have a——

Mr. PEACE. I agree.

Mr. WALGREN [continuing]. Tough time and others will not have such a tough time.

Mr. PEACE. I agree.

Mr. WALGREN. So, you ought to be looking for some way to——

Mr. PEACE. We are not really, Mr. Walgren, not really anticipating that in the case of the Appalachian Project. The public support seems to be very high. But all it takes, I think I am saying, is one person who doesn't like what we're doing, and it could delay the whole thing.

Mr. WALGREN. Yes; I see.

Mr. Davis.

Mr. DAVIS. I would like to comment on that, too, because the environmental issue is very important to our technology. The observation is, and our feeling anyway, in the State of Wyoming, the State of Wyoming is very rigorously protecting the environment, meeting existing State regulations will, I think, ensure protection of the environment, and relief from Federal regulations of the type that he's talking about, I think, are important.

We know how to deal with the State regulatory issue, and that's, frankly, much better established, much easier to deal with, than the Federal.

Mr. WALGREN. Other comments on the Federal environmental procedures?

Mr. SHANNON. We find it burdensome and onerous, and to some extent, haven't got a full grasp of it yet.

Mr. WALGREN. That's sort of a difficult problem to deal with because there are lots of concerns on the other side as well, and we probably are not in a position just to—just to give blanket waivers, legislatively, without knowing what we're getting into. I guess we did that in the SFC, didn't we? But that was with the real drive of a national crisis at the time. It's hard to know how we could develop that. But that's a very good point, and we will try to be sensitive to it.

Thank you, Mr. Chairman.

Mr. TRAFICANT. Thank you, Mr. Walgren. I just want to take a moment to say that much of your leadership in the Committee on Science and Technology is evidenced in the steel initiative legislation and clean coal technology. I just wanted to commend you for that.

Before I move to Mr. Sensenbrenner, I would like to have the unanimous consent of the committee that any studies that may have been performed on respective individuals' technologies here they've testified about or any particular letters of commitment or support and/or financial contracts which would be in support of their projects be added to and incorporated into the permanent part of the record. Without objection, it will be so ordered.

Mr. Sensenbrenner, from Wisconsin, do you have any questions?

Mr. SENSENBRENNER. No questions, Mr. Chairman.

Mr. TRAFICANT. I wanted to thank this committee and maybe just ask one brief question if we could. Individually, what is the major obstacle that you face now—be it through the negotiations or be it through whatever other problems you might have—what is the major obstacle you have now in moving your technology forward to help the country and perhaps solidify your application and become approved here? Mr. Davis.

Mr. DAVIS. Frankly, our major concern is one expressed earlier, is the uncertainty of the schedule of completion of negotiations.

Mr. TRAFICANT. The schedule of completion or the——

Mr. DAVIS. Putting in place, and after all the approval cycle, you know, when can we start our program? We have weather windows, we have other concerns, and it's very difficult to go out and put together a program of the type we're talking about with an uncertainty factor in the order of several months as to knowing when it will be complete.

Mr. TRAFICANT. You have been notified of your first negotiation, or the development of negotiation by the department?

Mr. DAVIS. Well, we have completed submission of first round of questions, and we had a preliminary meeting with Morgantown, and they seem to be moving as expeditiously as possible. We recognize that these take time. But frankly, after the negotiation of an agreement, going back into Congress and that uncertainty of how long it will take to get out of Congress is an uncertainty that we can't—we can't—we can't gauge, we can't calibrate.

Mr. TRAFICANT. Mr. Horner.

Mr. HORNER. I will just repeat, as expressed in my testimony, the two major concerns are the 30-day legislative day requirement, which we believe could compromise an expeditious agreement; and second, the recoupment requirement that DOE has added to the legislation. We believe it's serious impediment to the whole negotiation process.

Mr. TRAFICANT. Is your negotiation process——

Mr. HORNER. We had likewise submitted an information package, which we were given 30 days to complete, and have had a preliminary executive discussion with DOE. We have not started the negotiations.

Mr. TRAFICANT. Mr. Peace.

Mr. PEACE. Yes; I am not overly concerned about any of the negotiating aspects. I am concerned, as I mentioned earlier, about the environmental issue that may be out there waiting on us. We have a lot of work to do, a lot of negotiating with DOE and with our partners and with others, but I think that will go smoothly. At least I am expecting it will. But I am concerned about the 30-day notice and the environmental question.

Mr. TRAFICANT. In your case has the State of Pennsylvania been in close contact with you relative to the environmental concerns?

Mr. PEACE. Yes. The site we're using is a site that we've been addressing for quite some time. It was a site for the previous Keystone Project. So we have a lot of data on that site over a long period of time, and the Pennsylvania Department of Energy—or, Department of Environmental Resources has really seen no particular problems at all with the project. We think we will be able to get the State environmental permitting done on a timely basis.

Mr. TRAFICANT. Mr. Shannon, major obstacles, as you see them?

Mr. SHANNON. We have good technology, good economics, markets, investors. Our next major block or step—I wouldn't call it a block—is to get a conditional letter of commitment from DOE so that we can proceed and continue our work while we negotiate the contract.

Mr. TRAFICANT. Have you been notified for your contract negotiations, or have you begun this process?

Mr. SHANNON. No; we just had the letter July—August 1 or whatever it was—which just named the nine companies and said that they would—we would be notified for negotiations. We asked that—and they said one of the things is a detailed financial plan. I see an obstacle here that without—these are new technologies, this is a prototype, it's going to be a demonstration, and it needs Government assistance, and without the commitment of the Government it's difficult to put the balance of the financial plan together.

We have made all the assumptions we can on the $45 million with Merrill Lynch and others, and until we have some paper on that in some conditional form or some way, we can't move any further.

Mr. TRAFICANT. In your case, with all this private financing that you have to put together, evidently, for this detailed packet of information others have been referring to, isn't it a fact that being one of the nine awardees is evidence enough that your application has been preapproved, at least, to the point of Federal participation of $45 million. Have you had any written correspondence on any problems with any future investors relative to that?

Mr. SHANNON. The paper that we got, it was such a generalized piece of paper that it's just not satisfactory. I took that to other—to the very friendly investors I have, but to others that judge my—they'd judge me as weak in all aspects of business judgment if I was to assume on that piece of paper I had anything from the United States Government.

Mr. TRAFICANT. Well, I want to thank this panel, and naturally the first two panels dealt with those individuals that had some favorable report so far, so that I hope that as you move down to negotiations, that you would, you know, not only just work very hard but keep in mind the intent of the Congress, and that hopefully we can help to solve some of our energy crises as well as abate this acid rain situation.

I thank you very much.

The third panel will consist of the 5 of the 14 firms who are on standby.

I would like to announce before we move into this that we have just been notified that the House will begin a series before long of votes that maybe rapid in order and will cause the committee and its members to be up and moving back and forth between this committee room and the House for such votes. So, if possible, if you could maybe condense, not to shorten it—if you have a salient point that must be made, certainly go ahead and make it, but if you could, to make sure that the committee would have an opportunity for questions, I would recommend that to you.

The third panel will consist of Mr. Wait III, director, electric department, city of Tallahassee; Mr. Boston, senior vice president, Wisconsin Electric Power Co.; Mr. Albert Smith, director of plant design, Southwestern Public Service Co.; Mr. Richard Wolfe, vice president, research and development, United Coal Co.; and Mr. Anthony Stathoplos, director, Kreisinger Development Laboratory, Combustion Engineering.

We will start out, if you will, with Mr. Wait.

Mr. BARTON. Mr. Chairman.

Mr. TRAFICANT. Yes.

Mr. BARTON. Mr. Chairman, I am probably going to have to leave before this panel finishes their discussion. I would like to submit for the record a statement which basically says that I am very interested in the project that the Southwestern Power Co. is considering. It's very similar to a project that's under consideration in my congressional district. I would like to submit that statement for the record at this time.

Mr. TRAFICANT. Without objection, it will be so noted.

[The prepared statement of Mr. Barton follows:]

STATEMENT OF CONGRESSMAN JOE BARTON (R-TEXAS)

BEFORE

THE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

ENERGY DEVELOPMENT AND APPLICATIONS SUBCOMMITTEE

HEARING ON

"CLEAN COAL TECHNOLOGY SOLICITATION"

SEPTEMBER 11, 1986

Mr. Chairman, I would like to express my enthusiasm for the Department of Energy clean coal project program. As you know, Texas is considered to be one of the greatest oil and gas producer regions in the history of mankind. It is also one of the largest coal producer states in the United States, ranking 8th in terms of coal production nationwide.

The bulk of the Texas coal reserves are lignite, a very clean coal that has great potential for electricity generation compatible with the environment in the Southwest and other regions. Those of my colleagues who are concerned with environmental problems such as acid deposition should welcome the ongoing development of the Texas lignite belt. As you can imagine, I am a supporter of the lignite coal industry, and applaud their growth in recent years.

I would also like to express my particular interest in the Southwestern Public Service Company project located in Amarillo, Texas. I understand that the Energy International project will use circulating fluidized bed technology very similar to that being used in a project under consideration in Robertson County in my Congressional district. In fact, the architect-engineer for the project in Amarillo is the same for the project in Robertson County.

For the benefit of the subcommittee, the Texas-New Mexico Power Company project under consideration in Robertson County, Texas will be the largest power plant of its type ever built, and it utilizes very clean coal burning technology. The plant will use a technology that is relatively new to the United States but that has been in use in Germany for over twenty years. It is my understanding that this technology permits the construction of a coal plant that meets all air emission standards and does not require scrubbers. As you know, the end product of these scrubbers raises disposal problems.

The unique operating characteristics of the circulating fluidized bed allow for a more efficient coal burn, providing a greater efficiency to the plant. Because the coal does not have to be ground to a fine dust, there are not many mechanical problems with the coal handling equipment, thus providing greater reliability of that equipment. Finally, because of the relatively low burning temperatures of the fuel in the boiler, there is no buildup of slag, thus saving many hours and dollars of maintenance. All these characteristics combine to give this plant a 90% plus availability factor which is heretofore unheard of for a coal plant.

According to the Department of Energy, "This promising technology is capable of burning coal cleanly and efficienty." Construction of this plant is a step towards our national goal of U.S. energy independence. I attach a copy of a letter from DOE to my predecessor in the House, Senator Phil Gramm.

Department of Energy
Washington, D.C. 20545

August 12, 1986

Honorable Phil Gramm
United States Senate
Washington, D.C. 20510

Dear Senator Gramm:

This is in response to your letter of July 30, 1986, to Secretary John Herrington regarding the proposed Texas-New Mexico Power Company's lignite burning circulating fluidized bed power plant.

The Texas-New Mexico Power Company (TNP) is to be commended for its decision to install circulating fluidized bed combustion (FBC) technology for the generation of electricity to meet its customers' needs. Circulating FBC technology is well suited for burning high ash coals such as the lignite that is to be burned in the TNP installation. Moreover, the use of this technology is consistent with the Administration's policy to increase the utilization of coal, thereby promoting a balanced and mixed energy resource system to provide an adequate supply of energy at reasonable costs. Circulating FBC technology is considered an advanced or improved type of FBC technology. This promising technology is capable of burning coal cleanly (meets New Source Performance Standards) and efficiently. The FBC process provides its own control for SO_2 and NO_x emissions. By including a suitable sorbent as part of the bed material, such as limestone, the SO_2 released during combustion can be absorbed thus eliminating the need for downstream scrubbers. Nitrogen oxides (NO_x) are controlled because the FBC operating temperature is well below the thermal-NO_x formation point. Particulates can be collected using a baghouse. It also provides several other advantages over conventional combustion technologies. They include its ability to burn a large variety of coals and low-value fuels (lignite, peat), the boiler's compactability, the production of easily disposable solid wastes, and the projected lower steam costs for the system. In addition, circulating FBC technology has the added advantage of utilizing a simpler fuel preparation and handling system--crushing is sufficient preparation.

In keeping with its technology development policy, the Department of Energy encourages private industry to commercialize advanced concepts for burning coal like the circulating FBC technology, and is therefore pleased to provide these comments on the TNP proposed plant.

If I can be of any further assistance, please do not hesitate to contact me.

Sincerely,

J. E. Walsh, Jr.
Deputy Assistant Secretary
for Management, Planning
and Technical Coordination

Mr. SENSENBRENNER. Mr. Chairman.

Mr. TRAFICANT. Mr. Sensenbrenner from Wisconsin.

Mr. SENSENBRENNER. I would like to introduce my constituent, John Boston, who is the senior vice president of Wisconsin Electric Power Co. Wisconsin Electric has got a direct stake in clean coal technology and solving the acid rain problem because of the over 8,000 inland lakes in Wisconsin, and he is a recognized leader in research and development of coal-fired powerplants.

Now, having made this introduction, I would like to ask unanimous consent that the prepared testimony of each of the witnesses in this panel be included in the record.

Mr. TRAFICANT. Without objection.

Mr. SENSENBRENNER. And emphasize the fact that once the bell starts ringing for votes, I doubt that we're going to be able to get this hearing started up again because we will be shuffling back and forth between here and the House floor.

So I want to emphasize the chairman's point that, please, really condense your statement, and the punchier and the quicker the better.

Mr. TRAFICANT. With that, we turn to Mr. Wait. Would you get the microphone, Mr. Wait, and turn it on, please? There you go.

STATEMENT OF BENJAMIN W. WAIT III, DIRECTOR, ELECTRIC DEPARTMENT, CITY OF TALLAHASSEE

Mr. WAIT. Mr. Chairman, members of the subcommittee, staff, ladies and gentlemen, the city of Tallahassee, FL, and its municipal electric utility system appreciate this opportunity to present testimony to this subcommittee concerning the Department of Energy's Clean Coal Technology Program. The city is very interested in this program, as evidenced by our submission of statement of interest in the program in 1985 and by our submission of proposal for the project in April of this year.

The city believes this program is of major importance to the electric utility industry, since more and more emphasis is being placed on the generation of electricity utilizing technology to burn coal cleanly. The city's proposals to the DOE consists of retrofitting an existing 235-megawatt turbine generator with the new circulating fluidized bed combustor or boiler at its existing Arvah B. Hopkins Generating Station. Electricity from this generator and this new boiler would continue to be distributed to the city's nearly 70,000 customers.

The important characteristics of the project include: No. 1, it is a retrofit project which is applicable to a variety of situations throughout the Nation. It is of a size that is directly applicable both to retrofit projects and to new units. It will be constructed at a cost that primarily will be paid for by the city.

As the direct construction cost we have asked for Government participation of approximately 27 percent, with the city supplying 73 percent. Of the total financed cost of this project, the figures would be revised to the city participating to the extent of approximately 83 percent and the Federal Government approximately 17 percent.

It is being—this project—is being proposed at a time when the electric utility industry is in need of a viable and commercially available technology to burn coal cleanly. The city has gathered a project team of unequalled experience, in our opinion, including the staff, Combustion Engineering Lurgi, Bechtel North American Power, Westinghouse Electric Corp., R.W. Beck & Associates, the Dean Witter Reynolds, & Goldman Sachs.

The city has selected this technology for retrofit due to its operational and environmental advantages. The technology has the flexibility to burn a variety of fuels, including Eastern United States high-sulfur coals and inexpensive low-grade fuels with high-ash and high-sulfur content. It can burn these coals while minimizing sulfur dioxide and nitrogen oxide emissions. In addition, the solid waste produced by the combustion process is readily disposed of.

The circulating fluidized bed technology has been tested at smaller sizes, but has not been demonstrated at the size that we are proposing for this retrofit, and we think that that is essential to the electric utility industry.

We believe our proposed demonstration project will be an excellent example to utility managers throughout the country to resolve the uncertainty concerning this technology. We believe that it will apply to the whole energy industry and the energy industry will benefit from having this demonstrated energy alternative, as they consider particularly the installation of retrofit units and new units in the 200 to 400-megawatt-size range.

In addition, we believe the U.S. coal industry will directly benefit from the technology that is capable of burning a wide variety of coals, especially the Eastern United States high-sulfur coals.

DOE has reviewed key aspects, some seven emerging clean-coal technologies. I have prepared some tables, which have been submitted previously, with respect to that. Various technologies were examined, including atmospheric fluidized bed, of which the circulating fluidized bed is one type.

DOE is currently negotiating with nine entities in six of these technological areas. The seventh, and certainly one of the most promising areas, is totally missing from what—from the DOE list in the first nine. No atmospheric fluidized bed projects are being considered for cost sharing by DOE at this time. Quite frankly, this is very surprising to us and, I think, to others, considering the superior ratings that this technology has received in the DOE study with respect to its expected environmental performance, technical maturity, applicability, and cost effectiveness.

It appears that atmospheric fluidized bed is much closer to true industry application. All it needs is a little help from you.

The city is particularly interested in the proposed project, for a variety of reasons. The city is in need of a new coal——

Mr. **Traficant**. Mr. Wait.

Mr. **Wait**. Yes.

Mr. **Traficant**. I don't want to interrupt, but if that is a part of your record, we would ask if you could condense, and your written statement will be submitted and made a part of the record. I don't mean to interrupt, but for the importance of time and for the others, if you could condense, we would appreciate it.

Mr. Wait. All right, sir. Let me go on. I would like to point out that we think that the city of Tallahassee is an excellent place for a facility of this type to be built because it is the State capital. It's a highly visible municipal system, where we can see the powerplant from the third floor of city hall and the top at least 18 stories of the State capitol, which is next door to the city hall. We are in daily contact with the Florida Department of Environmental Regulation, the Florida Public Service Commission, and we have received lots of support from those areas.

Further, the public itself has had wide input into what we're doing in Tallahassee, both at city commission meetings, from citizen action energy committees, and that sort of thing, and the public appears to be behind this kind of a project. It would receive wide support in Tallahassee.

Frankly, we can think of no better way to spend a portion of the $350 million reserve than through the circulating fluidized bed technology to complement the current program.

Thank you for the opportunity to make this presentation.

[The prepared statement of Mr. Wait follows:]

Testimony Before the U.S. House of Representatives
Committee on Science and Technology
Subcommittee on Energy Development and Applications

Presented by Benjamin W. Wait, III, P.E.
Director, Electric Department
City of Tallahassee, Florida
September 11, 1986

Mr. Chairman, members of the subcommittee, ladies and gentlemen, the City of Tallahassee appreciates this opportunity to present testimony to this subcommittee concerning the Department of Energy's (DOE) Clean Coal Technology Program. The City is very interested in this program as evidenced by our submission of a statement of interest to the program in 1985 and by our submission of a proposal for a clean coal demonstration project in May of this year. The City believes this program is of major importance to the electric utility industry since more and more emphasis is being placed on generation of electricity utilizing clean coal technologies.

The City's proposal to the DOE consists of retrofitting a 235-MW Circulating Fluidized Bed Combustor (CFBC) at its existing Arvah B. Hopkins Generating Station. The CFBC boiler would replace an existing gas/oil-fueled boiler at the station, and steam produced by the new retrofit boiler would drive an existing 235-MW turbine generator. Electricity produced by the generator would be distributed to the City's nearly 70,000 customers. Important characteristics of the project include:

- it is a retrofit project which is applicable to a variety of situations throughout the nation.
- it is of a size that is directly applicable to both

retrofit projects and new units.

- it will be constructed at a cost that primarily will be paid by the City itself with 27 percent of the direct construction cost proposed as the Federal government's cost share, and
- it is being proposed at a time when the electric utility industry is in need of viable and commercially available clean coal technologies at a size useful to retrofits and new units.

In order to maximize the success of the project, the City has gathered a project team of unequalled experience, in our opinion. In addition to the City's staff, this team includes Combustion Engineering/Lurgi Corporation as a CFBC boiler designer, Bechtel North American Power Corporation as an architect/engineer, Westinghouse Electric Corporation as a turbine consultant, and R.W. Beck and Associates as a financing and environmental engineer.

The City has selected the CFBC technology for retrofit of its existing generating station due to its operational and environmental advantages. The technology has the flexibility to burn a variety of fuels including eastern U.S. high sulfur coals and inexpensive low grade fuels with high ash and high sulfur contents. It can burn these coals while minimizing sulfur dioxide and nitrogen oxide emissions from the boiler to the atmosphere. In addition, the solid waste produced by the combustion process is a dry solid material which has physical and chemical characteristics which are advantageous for final disposal.

The CFBC technology has been tested at smaller sizes but it has not been demonstrated at the size that we are proposing for this retrofit. Without such a demonstration, I could not, as a utility director, recommend to my management that the City of Tallahassee take the entire financial risk associated with development of a CFBC project. We believe you will find this same hesitancy throughout the utility industry today. Therefore, we believe our proposed demonstration will be an excellent example to help other utility managers resolve their uncertainty concerning this technology. We expect that the energy industry throughout the United States will benefit from having another demonstrated alternative available to evaluate and compare with other options for retrofit or new generation. We expect CFBC to be especially applicable to electric utilities as they consider retrofit of existing boilers requiring emission controls, and as they consider construction of new units that are in the 200- to 400-MW size range. In addition, we believe the U.S. coal industry will directly benefit from a technology that is capable of burning a wide variety of coals, especially the eastern U.S. high sulfur coals.

DOE reviewed the key aspects of the emerging clean coal technologies and reported its results to Congress in two reports during May and August of 1985. Various technologies were examined including atmospheric fluidized bed, of which CFBC is one type. Based to some extent on those analyses, DOE is currently negotiating with nine entities to develop demonstration projects in six of those technological areas. However, no atmospheric fluidized bed projects are being considered for cost sharing by DOE at this time. This is surprising to us, and I think others in the utility industry, considering the superior ratings that the technology received in the DOE study with respect to its expected environmental performance, technical maturity, applicability, and cost effectiveness. It is noted that a pressurized bed project is being considered for the DOE program. We feel that both atmospheric and pressurized fluidized bed technologies should be supported by Congress and DOE because there are significant differences between them and both have promising advantages for the energy industry. However, it appears that atmospheric fluidized bed is much closer to true industry application.

The City is particularly interested in the proposed project for a variety of reasons. We are in need of new coal-fueled generation capability and we have a generating station that is a good candidate for retrofit as indicated by a DOE study conducted in 1983. In addition, the City has explored a number of alternatives in detail and determined that CFBC is an attractive solution for our needs. We have showed our interest by putting a great deal of effort into preparing two detailed submissions to DOE and by gathering a project team that we believe is unequalled in the industry.

The City of Tallahassee is an excellent choice for demonstration of this project because the City has a documented need for coal-fueled generation, the City and the municipal industry have high visibility in the electric utility industry, and Tallahassee is located in a region of the United States where significant growth is expected in the future. The specific advantages of demonstrating this project near the City of Tallahassee include the following: 1) the City is the state capital which provides high exposure both technically and politically; 2) the City is also a highly visible municipal utility that is very open to sharing facts about this project with others in the energy industry; 3) the City is situated in a sensitive natural environment where demonstration of a technology capable of reducing acid gas emissions will be locally understood and appreciated; and, 4) the City has experience and an excellent record in management of cooperative projects with the Federal government.

In summary, the City has proposed a utility size scale up demonstration of a technology which can burn eastern U.S. coal cleanly and efficiently. The proposed technology is expected to find highly successful application in the industry because it offers many advantages to the electric utilities while helping to solve a national problem of how to use our coal reserves cleanly and economically. In addition, the City is enthusiastic about the technology and is committed to pursue a financially and technically feasible demonstration project in cooperation with the DOE.

Lastly, in addition to our written presentation which was made available today, we have a pamphlet summarizing our project available for anyone who would like one.

Thank you very much for allowing us to make this presentation.

CITY OF TALLAHASSEE, FLORIDA

ELECTRIC DEPARTMENT

TESTIMONY SUMMARY

BEFORE the

SUBCOMMITTEE on ENERGY DEVELOPMENT and APPLICATIONS

presented by

BENJAMIN W. WAIT, III, P.E.
Director, Electric Department

The City of Tallahassee is committed to pursue an economically feasible retrofit installation of a 235-MW circulating fluidized bed combustor (CFBC) to its existing Arvah B. Hopkins Generating Station. It is the City's belief that this project fits very well into the Department of Energy's Clean Coal Technology Program. We believe that this is in keeping with the intent of Congress when compared to the previous evaluations made by Congress of emerging clean coal technologies. The projects which have received awards to date were rated highly in those evaluations. Atmospheric fluidized bed combustors (AFBC), of which CFBC is one type, were rated higher than most technological alternatives scheduled to receive awards, yet received no award. The CFBC retrofit project of the City not only would fulfill this gaping void in the program, but also afford the demonstration of this type of fluidized bed technology as a viable, commercially available, alternative to the utility industry in the 1990's.

THE PROJECT

The City of Tallahassee's project will involve the retrofitting of the existing gas/oil fired Hopkins Unit 2 into a coal-fueled 235-MW steam electric power plant using the Combustion Engineering/Lurgi Corporation CFBC technology. This conversion would potentially reduce fuel costs by displacing the City's current dependence on gas and oil fuels with eastern U.S. coal and further reduce dependence on foreign oil. It also has the potential of reducing the current level of pollutant emissions when compared to the current technology employed at our site. The technology proposed has been successfully demonstrated in smaller size ranges typically used in industrial applications, but not demonstrated at the 200- to 400-MW range which is critical for serious commercial consideration by the electric utility industry during the 1990's.

Several elements of circulating fluidized bed technology need demonstration and verification at the 200- to 400-MW utility size range. As with any existing technology when scaling up by a factor of two over existing sizes, a certain amount of risk and uncertainty is involved. For our project, each of the four main components comprising a CFBC system will be tested: the combustor, recycle cyclones, fluid bed heat exchanger and the ash letdown system.

Through this unit's successful completion of start-up and intensive test program, the operating efficiencies, range limitation, heat transfer rates, emission capabilities, and other information will be revealed. Test data for this program will be collected using existing methods and reporting procedures. Continued operation of this facility will also demonstrate its reliability, maintenance requirements, and overall economics.

To further the success of our project, we have put together what we believe to be one of the most capable and experienced teams in this country or perhaps the world. The combined efforts of the City, Combustion Engineering/Lurgi as a combustor designer, and Bechtel North American Power Corporation for design engineering of the balance of the plant provide sufficient experience and manpower to overcome the challenges that will be faced by this project.

WHY ATMOSPHERIC FLUIDIZED BED?

Several different forms of fluidized bed combustor technology are currently being developed. The Emerging Clean Coal Program identified two key types; pressurized fluidized bed combustors (PFBC) and atmospheric fluidized bed combustors. As stated earlier, the City ~~of~~ Tallahassee CFBC project is one type of AFBC technology. Both PFBC and AFBC are reported to be at different stages with respect to commercial viability. The attached tables were excerpted in part from the Supplemental Report to Congress on Emerging Clean Coal Technologies. The summary shows where the recently awarded projects appear to fit into the program. In terms of AFBC, it would appear that this is a technology that does warrant serious consideration if the goals of developing clean coal technologies for the mid to late 1990's are to be maintained. The City of Tallahassee's retrofit proposal will provide a project that will demonstrate a unit size (235 MW) that will be seriously considered by the electric utility industry to meet the energy and pollution control needs of that industry in the 1990's. Further, our concern is that selecting only a PFB project for funding may result in putting all the eggs in one "technological basket" should the single selected demonstration project fall short of current expectations. If this were the case, other developing FBC alternatives may be delayed in getting to the market place in time to meet the needs of the electric utility industry or result in introducing a FBC technology that has a more limited commercial use then might otherwise be desired. This loss of time would delay the beneficial results that may be derived from FBC, namely, reduced pollution levels, stimulation of coal production, economic stimulus resulting from retrofitting or constructing new plants.

The City of Tallahassee is enthusiastic and committed to identification of a feasible demonstration of AFBC in the form of the proposed CFBC project in a size range that will be of near-term value to meeting the needs of the electric utility industry in the mid 1990's. We believe that the potential benefits afforded by this technology offset the technological problem areas as we will be confronting during this demonstration.

Finally, if various FBC technologies were made available in the commercial marketplace several advantages would be recognized including: providing a broader range of applications, stimulating competition, and providing several technological alternatives in the solution of our present and future energy needs.

EXCERPTS FROM EXHIBIT 1.b OF THE SUPPLEMENTAL REPORT TO CONGRESS ON EMERGING CLEAN COAL TECHNOLOGIES

Summary of Report Consultants' Evaluation Measures*

Technology	Overall Environmental Performance	Development Status	Year of Commercialization	Applicability	Projects with DOE Awards **
Sorbent Injection (LIMB)	Poor to Medium	First of a kind is operating	1990-1995	Low	2
Atmospheric Fluidized Bed Combustion	Good	First of a kind is under construction	1986-1990	Medium	0
Pressurized Fluidized Bed Combustion	Good	First of a kind is designed	1995-2000	Medium	1
Surface Coal Gasification	Good	Mature	1986-1990	High	3
Advanced Combustors	Medium	Pilot Plant	1986-1990	High	1
Coal Liquefaction	Good to Very Good	First of a kind is designed	1986-1990	High	1
Underground Coal Gasification	Good	First of a kind is designed	1995-2000	Medium	1

* Prepared for DOE under Contract #DE-AC21-85MC22121 during August 1985.

** This column indicates the number of projects currently being considered for DOE funding.

EXCERPTS FROM EXHIBIT 1.c OF THE SUPPLEMENTAL REPORT TO CONGRESS ON EMERGING CLEAN COAL TECHNOLOGIES

Rating of Clean Coal Technologies provided by Selected Experts*

Technical	Environmental Performance	Technical Maturity	Applicability	Cost Effectiveness	Projects with DOE Awards **
Sorbent Injection (LIMB)	Medium	High to Very High	Med to High	High to Very high	2
Atmospheric Fluidized Bed Combustion	Medium to High	High	High to Very High	Medium to High	0
Pressurized Fluidized Bed Combustion	Medium to High	Low to Medium	High	Medium	1
Surface Coal Gasification	Very High	Low to Medium	Med to High	High to Very High	3
Advanced Combustors	Low to Medium	Low to Medium	Low to Medium	Medium to High	1
Coal Liquefication	Low to Medium	Very to Low to Low	Low to Medium	Very Low to Low	1
Underground Coal Gasification	Medium	Very Low to Low	Low	Low	1

* Prepared for DOE under Contract #DE-AC21-85MC22121 during August 1985.

** This column indicates the number of projects currently being considered for DOE funding.

Mr. TRAFICANT. Thank you, Mr. Wait.
Mr. Boston.

STATEMENT OF JOHN W. BOSTON, SENIOR VICE PRESIDENT, WISCONSIN ELECTRIC POWER CO.

Mr. BOSTON. Mr. Chairman, members of the subcommittee, I am John Boston, senior vice president, Wisconsin Electric Power Co. I have prepared and submitted for the record a statement that I will only summarize at this time.

As part of the Clean Coal Technology Program, Wisconsin Electric submitted a proposal to demonstrate the commercial viability of pressurized fluidized bed combustion. The Port Washington clean energy project is the design, construction, and the operation of an 80-megawatt, turbocharged fluidized bed combustion steam supply system. Our cosponsors and financial contributors to the project are: Gilbert Commonwealth, Brown Boveri, Foster Wheeler Corp., Research-Cottrell, and Bechtel Construction.

Some of the project goals are: To provide an electric generating technology alternative to pulverized coal boilers that would require scrubbers or to coal gasification to meet new source performance requirements for air emissions. A very important part of the project is to demonstrate the unique offsite modular boiler construction techniques made possible by the major reduction in size of the boiler due to the high-pressure operation, which could revolutionize powerplant construction;

To demonstrate a potential for a major improvement in thermal cycle efficiency that has not occurred in the industry in many years. Successful demonstration of this technology will provide coal-burning utilities with the following advantages: An attractive steam supply system for refurbishment of existing plants; the ability to meet new capacity requirements with small, economic, generating units; the ability to utilize medium- and high-sulfur coals while meeting environmental requirements; and the reduction in construction time needed for field erection.

The PFBC systems are attractive alternatives to current, air-emission-control technologies. They allow air emissions to be controlled simultaneously with the combustion process rather than by adding complex equipment processes either before or after the combustion process, while at the same time reducing costs of electricity through lower construction costs and higher thermal cycle efficiencies.

One of the nine projects selected by DOE for funding is a pressurized fluidized bed demonstration, hosted by American Electric, the Tidd plant. I would like to emphasize that I am not here today protesting that selection at all. For of all the technologies selected for funding, none holds more promise of expanding the clean use of coal than PFBC. Rather, a technology of such significance for the utility industry and its consumers requires that alternative approaches be used in demonstrating its commercial viability. The Port Washington clean energy project is such an alternative approach.

Our project, based on the turbocharged pressurized fluidized bed combustion technology is ready for demonstration at a utility-scale plant. The Port Washington project is ideal for demonstration because it uses readily available technology for all areas of the plant except for the pressurized fluidized bed steam generator. By using conventional technology for the hot gas cleanup system and the turbocharger, more attention and effort can be focused on the pressurized fluidized bed steam generator.

Also, a key facet of our project is to demonstrate the ability to construct a complete steam boiler offsite in a factory setting, thereby reducing onsite construction time and costs and improving quality control.

Our project continues to have the support from both the project cosponsors and from project cofunders. The cosponsors believe the development of pressurized fluidized bed technology is vital to provide utilities with an alternative choice to meet SO_2 emission limits rather than being required to utilize flue gas scrubbing technology.

Wisconsin Electric cannot ask its customers and stockholders to take on the sole responsibility for the demonstration for pressurized fluidized bed. We believe it is a project that will benefit the entire Nation and, as such, should appropriately receive national support. I strongly urge the Congress to release the remaining $350 million reserve fund to develop retrofit technologies.

I also suggest that an emphasis on power generation projects would provide the most immediate benefits to coal producers, to coal users, and the electric power consumers. By releasing the funds this year, you can help ensure that retrofit technology will be available when needed in the mid-1990's. I am sure you are all aware that it is difficult to maintain together the excellent team of cosponsors if the project is not moving forward. Therefore, it would be in the best interest of the clean coal technology program if the current negotiations could continue to move ahead without delay and a decision made on the availability of the remaining $350 million in the clean coal technology reserve fund.

Thank you for the opportunity to appear today, and I would be happy to answer any questions.

[The prepared statement plus answers to questions asked of Mr. Boston by Mr. Sensenbrenner follow:]

TESTIMONY OF JOHN W. BOSTON
SENIOR VICE PRESIDENT
WISCONSIN ELECTRIC POWER COMPANY
BEFORE THE
ENERGY DEVELOPMENT AND APPLICATIONS SUBCOMMITTEE
OF THE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE
SEPTEMBER 11, 1986

Chairman Fugua and members of the subcommittee, I am John W. Boston, Senior Vice President of Wisconsin Electric Power Company, Wisconsin's largest electric utility. We supply energy services to more than two million people in a 12,000 square mile service territory in both Wisconsin and Upper Michigan. I welcome the opportunity to provide this testimony at this hearing on "Assessment of Department of Energy's Clean Coal Technology Program" and our project known as the Port Washington Clean Energy Project, (PWCEP).

Wisconsin Electric has a long and successful tradition of leadership in research and development programs for coal-fired power plants. Early in this century, we were the first utility in the world to burn pulverized coal for the generation of electricity, and we constructed the world's first plant built to burn pulverized coal exclusively. Our pioneering efforts in coal research led to world records in power plant efficiency.

In that same tradition, on December 2, 1985, we announced plans to convert four units at our Oak Creek Power Plant to atmospheric fluidized bed combustion. We believe that AFBC is a commercially viable technology and Wisconsin Electric is committing over $400 million to this 500 MW conversion. This project, in conjunction with fuel switching and the PWCEP will reduce Wisconsin Electric's 1993 sulfur dioxide emissions by 50% from 1970 levels despite a 64% increase in generation during that period.

Our latest project, the Port Washington Clean Energy Project, is the design, construction, and operation of an 80 MW turbocharged pressurized fluidized bed combustion (PFBC) steam supply system. Our co-sponsors are Gilbert/Commonwealth, BBC Brown Boveri, Foster Wheeler Energy Corporation, Research-Cottrell, and Bechtel Construction. The project goals are to:

° Demonstrate the capabilities of a commercial scale PFBC steam supply system.

° Provide an electric generating technology alternative to pulverized coal boilers with scrubbers or coal gasification to meet New Source Performance requirements for air emissions.

° Demonstrate unique off-site modular boiler construction techniques which could revolutionize power plant construction.

° Demonstrate a potential for up to 2% thermal cycle efficiency improvement.

° Allow upgrading to combined cycle operation with 4% improvement in thermal cycle efficiency when advanced hot gas clean-up technology has been demonstrated.

Successful demonstration of this technology will provide coal burning utilities with the following advantages:

° An attractive steam system for refurbishment of existing plants.

° The ability to meet new capacity requirements with small, economic generating units.

° The ability to utilize medium and high sulfur coals, while meeting environmental requirements.

° Reduction in time needed for field erection.

° Need for less auxiliary environmental equipment because emission removal is part of combustion process itself, rather than utilization of a complex chemical processing plant.

° Improved siting flexibility.

PFBC can address the serious industry concerns arising from long construction lead times, emission control technology and forecasting uncertainties.

A study by the Electric Power Research Institute indicates that off-site, modular boiler construction will reduce both plant capital cost and plant construction time.

PFBC systems are attractive alternatives to current air emissions control technologies. They allow air emissions to be controlled simultaneously with the combustion process rather than by adding complex equipment processes either before or after the combustion process. In addition, a more environmentally desirable dry waste product is obtained from fluidized bed combustion.

A third major industry concern - matching capacity additions closely to demand growth—is also addressed by pressurized fluidized bed combustion. This technology affords the opportunity to add generation facilities in increments which closely match the system demand needs. It also requires less space which makes possible the retrofit of existing coal fired boilers without significant modification of remaining plant equipment.

A survey of industry experts conducted by Gilbert/Commonwealth suggests that over 30% of the boiler replacements required after 1995 for environmental reasons will be PFBC. Ten percent of the retrofits undertaken for life extension of aging plants, and over 25% of those done because of fuel switching will also be PFBC. The total potential capacity seen for PFBC retrofits is almost 35,000 MWe.

Turbocharged pressurized fluidized bed combustion technology is ready for demonstration at a utility scale plant. The Port Washington project is ideal for demonstration because it uses readily available technology for all areas of the plant except the steam generator. By using conventional technology for the hot gas clean-up system and the turbocharger, more attention and effort can be focused on the PFB steam generator.

One of the nine project candidates selected by the DOE for funding is a pressurized fluidized bed demonstration hosted by American Electric Power at its Tidd plant. I would like to emphasize that I am not here today protesting that selection, for of all the technologies selected for funding, none holds more promise of expanding the clean use of coal than PFBC. Rather, a technology with such potential significance for the utility industry and its consumers requires that alternative approaches be used in demonstrating its commercial viability. The differences between our two approaches to pressurized fluidized bed demonstration are significant, and funding of both projects is in the public interest.

The Port Washington Clean Energy Project continues to have support from both the project cosponsors and from the projects' cofunders. The cosponsors believe the development of pressurized fluidized bed technology is vital to provide utilities with an alternate choice to meet SO2 emission limits rather than the utilization of flue gas scrubbing technology. The PWCEP proposed schedule calls for testing to be completed in 1993. Successful demonstration would coincide with the same time period when electric utilities will be making decisions on generation capacity additions for the late 1990's.

Governor James Thompson of Illinois, in a July 7, 1986 letter (copy attached) to Secretary of Energy, John S. Herrington, provides an example of cofunders support for the PWCEP. "The turbocharged PFBC represents a technical option which will comply with environmental performance standards for new plants at substantial savings and will, also, provide a highly desirable alternative for utilities planning to install retrofit technologies in order to extend the life of existing plants. This is the first time that we have ever pledged funds to a demonstration project outside of Illinois in our ten-year history of supporting clean coal technology development, and we have done so because we believe that PFBC technology has particular merit."

I should point out that the entire Wisconsin Congressional delegation, Governor Anthony Earl and the Wisconsin Department of Natural Resources have strongly supported this project from its inception.

Wisconsin Electric cannot ask its customers and stockholders to take on the role responsibility for demonstrating the PFBC. We believe it is a project that will benefit the entire nation and as such should appropriately receive national support. Neither can we ask the federal government for total financial support. That is why Wisconsin Electric has an ambitious international campaign under way to seek additional funds for this project from the coal and utility industry, and others that would benefit from a demonstration of the commercial viability of the PFBC technology.

Wisconsin Electric has supported the Clean Coal Technology program since it was first proposed. The nine projects already selected represent a broad range of technologies which will provide a solid beginning for the expansion of clean coal use. But these nine projects are just a start.

I strongly urge the Congress to release the $350 million reserve fund to develop retrofit technologies. I also suggest that an emphasis on power generation projects would provide the most immediate benefits to coal producers, users and electric power consumers. By releasing the funds this year, you can help ensure that retrofit technology will be available when needed in the mid-1990's.

Thank you for the opportunity to appear today. I would be happy to answer any questions at this time.

NBC/bah

STATE OF ILLINOIS
OFFICE OF THE GOVERNOR
SPRINGFIELD 62706

JAMES R. THOMPSON
GOVERNOR

July 7, 1986

Honorable John S. Herrington
Secretary of Energy
U. S. Department of Energy
1000 Independence Avenue, S.W.
Room 7A-257
Washington, D.C. 20585

Dear John:

We have had several discussions over the past year about the importance of the Clean Coal Technology Program to the State of Illinois. I am writing to you now to convey my continued support for the national program and for the proposed Illinois projects. I do so from the view that the Clean Coal Technology Program can be the central component of a major federal policy initiative of great significance to my state and the nation.

The Congress is currently engaged in the consideration of acid rain legislation that would decimate the midwest coal industry. The debate over acid rain has taken on international dimensions with our closest neighbors. Wisconsin and other states have already implemented stringent sulfur dioxide and nitrous oxide emissions standards. The State of Illinois and other eastern coal-producing states face the immediate and critical challenge of finding the technological means to allow power plants to continue using locally available coal. The DOE program offers the most constructive approach to reducing pollutant emissions, while allowing the continued use of our coal and maintaining thousands of jobs in already depressed areas.

Within the context of the national acid rain dilemma, the development of retrofit technologies is particularly important. In response to the Clean Coal Technology Program solicitation, the State of Illinois has joined with the Gas Research Institute of Chicago to provide 50 percent of the funds required by the Energy and Environmental Research Corporation to demonstrate important new technologies for the control of sulfur and nitrous oxide emissions from coal-fired power plants. These new technologies combine natural gas reburning and sorbent injection within the coal-fired boiler to reduce sulfur emissions by 50 to 70 percent and nitrous oxide emissions by 60 percent. The gas reburning and sorbent injection technology can be retrofitted to provide very cost-effective control of emissions from existing boilers without switching to low sulfur coal or installing costly scrubbers. Under our proposal, the technology would be demonstrated in three Illinois power plants. As each of the plants uses one of the three major utility boiler types utilized in the United States, the successful demonstration of this technology could lead to rapid emission reductions in other plants nationwide.

Illinois has also committed one million dollars to the support of a turbocharged pressurized fluidized-bed combustion (PFBC) project, which has been submitted to the Clean Coal Technology Program by a utility/industry group headed by Wisconsin Electric Power Company. The turbocharged PFBC represents a technical option which will comply with environmental performance standards for new plants at substantial savings and will, also, provide a highly desirable alternative for utilities planning to install retrofit technologies in order to extend the life of existing plants. This is the first time that we have ever pledged funds to a demonstration project outside of Illinois in our ten-year history of supporting clean coal technology development, and we have done so because we believe that PFBC technology has particular merit.

The technology demonstration projects that Illinois has committed to support have been carefully selected from a range of potential systems. These important technologies cannot be fully proven in the laboratory or at pilot scale. Full size tests in commercial settings are necessary to validate their technical performance and economic benefits. I hope that DOE will give favorable consideration to sharing in the demonstration of this technology.

The State of Illinois remains committed to the clean coal approach in dealing with the acid rain issue, and we are very happy to have you as an ally in this important national issue. I assure you that I will continue to provide my earnest support to the DOE program, and I pledge the resources of my state to ensuring its future success. I look forward to having you visit Illinois in the near future to discuss these and other matters of mutual interest.

Sincerely,

James R. Thompson

James R. Thompson
GOVERNOR

DON FUQUA, Florida, Chairman

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GEORGE E. BROWN, JR., California
JAMES H. SCHEUER, New York
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U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
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DAVID S. MONSON, Utah

HAROLD P. HANSON
Executive Director
ROBERT C. KETCHAM
General Counsel
R. THOMAS WEIMER
Republican Staff Director

September 11, 1986

Mr. John W. Boston
Wisconsin Electric Power Company
231 West Michigan
P.O. Box 2046
Milwaukee, WI 53201

Dear Mr. John

Thank you for your excellent testimony this morning before the Subcommittee on Energy Development and Applications. Enclosed are a number of questions Republican Members of the Subcommittee would like you to answer, in order to supplement the record of the hearing.

We would appreciate your responses to these questions by October 1, 1986. If you have any questions regarding this request, please contact Mr. David Beightol of the Subcommittee Staff at 225-6399.

Sincerely,

Jim

F. JAMES SENSENBRENNER
Ranking Republican

DB:kg
Enclosure

Questions for the Record
EDA Subcommittee Hearing
"DOE's Clean Coal Technologies Programs"

September 10, 1986

1. What steps other than the Port Washington Project has Wisconsin Electric taken to reduce SO_2 emmissions?

2. What is unique about your Port Washington Clean Energy Project off-site boiler construction? What are its potential benefits?

3. Why do you suggest that DOE emphasize power generation projects for funding?

Wisconsin Electric POWER COMPANY
231 W MICHIGAN P O BOX 2046 MILWAUKEE WI 53201
(414) 277-2345

September 29, 1986

The Honorable F. James Sensenbrenner, Jr.
U. S. House of Representatives
2444 Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Sensenbrenner:

Thank you for the opportunity to present testimony before the Subcommittee on Energy Development and Applications. Enclosed are responses to the questions submitted by Subcommittee members in your letter of September 11, 1986.

Rapid development of clean coal technologies is vitally important to the nation's future well being. Your strong support for the Clean Coal Technology Program and our Port Washington Clean Energy Project is greatly appreciated.

Sincerely,

John W. Boston
Senior Vice President

NHP/db

Enclosure

Responses of John W. Boston
Senior Vice President, Wisconsin Electric Power Company
to
Questions for the Record
Energy Development & Applications Subcommittee Hearing
"DOE's Clean Coal Technologies Programs"

1. What steps other than the Port Washington Project has Wisconsin Electric taken to reduce sulfur dioxide emissions?

A: In addition to the Port Washington Project, Wisconsin Electric Power has implemented plans to dramatically reduce future sulfur dioxide emissions. In December of 1985, we announced plans to convert four units at our Oak Creek Power Plant to atmospheric fluidized bed combustion. We believe that AFBC is a commercially viable technology and Wisconsin Electric is committing over $400 million to this 500 MW conversion. This project, in conjunction with fuel switching and the PWCEP will reduce Wisconsin Electric's 1993 sulfur dioxide emissions by 50% from 1970 levels despite a 64% increase in generation during that period.

2. What is unique about your Port Washington Clean Energy Project off-site boiler construction? What are its potential benefits?

A: The pressurized boiler is approximately one-fifth the size of a comparable conventional boiler. The smaller size makes it possible to shop fabricate the complete boiler, cyclone and flue gas clean-up system in separate modules which are transportable by barge. Shop fabrication will allow better quality control of work and significantly reduce field erection time. Studies indicate that the reduction in field erection time will yield substantial savings for consumers.*

The reduced erection time will shorten lead times for electric utilities ordering new capacity, thereby reducing financing costs and lessening risk for regulators and utilities alike. Finally, the successful demonstration of the shop fabricated PFBC boiler will make smaller capacity unit additions economical. These smaller capacity units will allow electric utilities to more closely match load growth.

3. Why do you suggest that DOE emphasize power generation projects for funding?

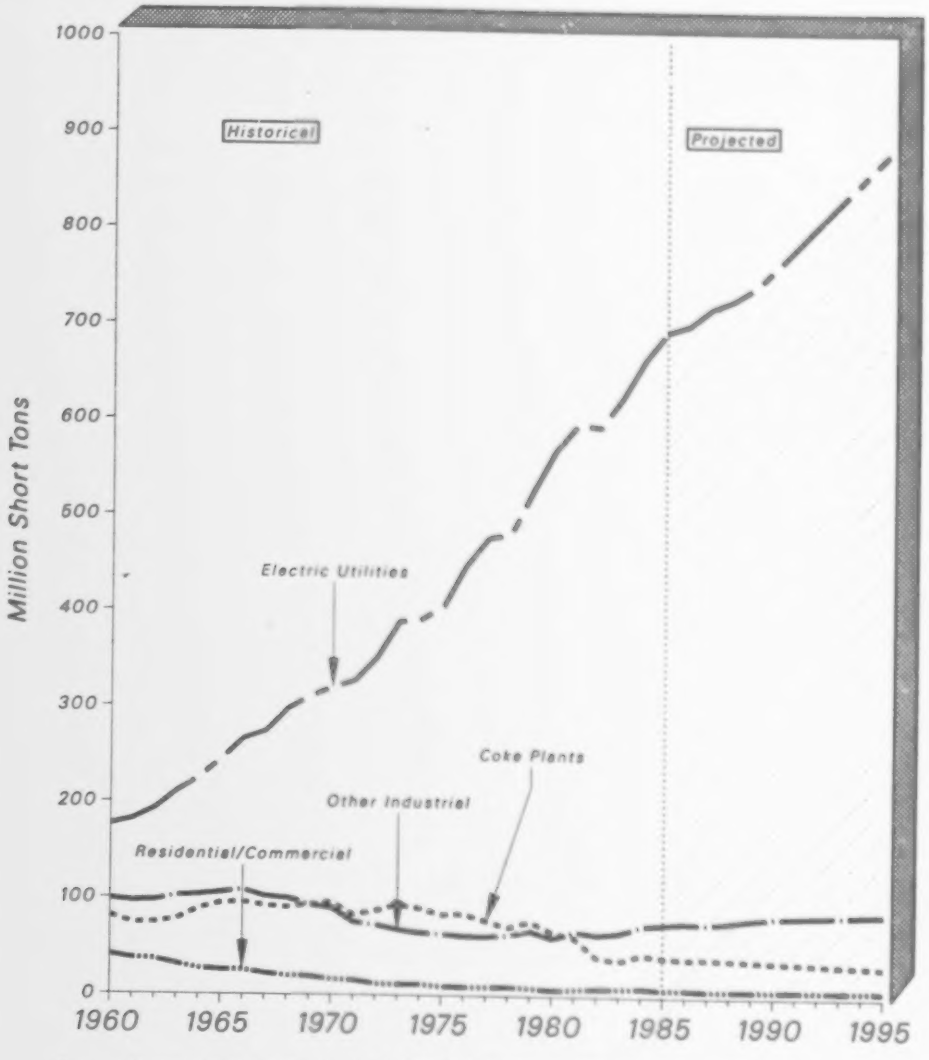
A: According to the Energy Information Administration of the Department of Energy, the electric utility industry was responsible for 85% of U.S. coal consumption in 1985. The same EIA report states that the electric utility percentage of consumption will approach 90% by 1995.**

Emphasis by DOE on electric generation technologies like the Port Washington Clean Energy Project will allow the largest coal consumer to burn a wide variety of coals cleanly, without expensive scrubbers. Such an emphasis will benefit both utility consumers and coal producers.

* Electric Power Research Institute, E.A./C.S.-4158, Sept. 1985.
** Quarterly Coal Report, DOE/EIA-0121 (86/1Q).

September 29, 1986

Figure B3. Coal Consumption Trends



Sources: Energy Information Administration, *Annual Energy Review 1984*; *Annual Energy Outlook 1984*; *Short-Term Energy Outlook* (April, 1986); and Coal Data: A Reference.

Table B3. Coal Consumption Trends
(Million Short Tons)

Year	Electric Utilities	Coke Plants	Other Industrial	Residential and Commercial	Total
1960	176.7	81.4	99.1	40.9	398.1
1961	182.2	74.2	96.7	37.3	390.4
1962	193.3	74.7	97.7	36.5	402.3
1963	211.3	78.1	102.6	31.5	423.5
1964	225.4	89.2	103.8	27.2	445.7
1965	244.8	95.3	106.2	25.7	472.0
1966	266.5	96.4	109.3	25.6	497.7
1967	274.2	92.8	102.3	22.1	491.4
1968	297.8	91.3	100.8	20.0	509.8
1969	310.6	93.4	93.5	18.9	516.4
1970	320.2	96.5	90.5	16.1	523.2
1971	327.3	83.2	75.8	15.2	501.6
1972	351.8	87.7	73.0	11.7	524.3
1973	389.2	94.1	68.2	11.1	562.6
1974	391.8	90.2	65.0	11.4	558.4
1975	406.0	83.6	63.7	9.4	562.6
1976	448.4	84.7	61.8	8.9	603.8
1977	477.1	77.7	61.5	9.0	625.3
1978	481.2	71.4	63.1	9.5	625.2
1979	527.1	77.4	67.7	8.4	680.5
1980	569.3	66.7	60.3	6.5	702.7
1981	596.8	61.0	67.4	7.4	732.6
1982	593.7	40.9	64.1	8.2	706.9
1983	625.2	37.0	66.0	8.4	736.7
1984	664.4	44.0	73.7	9.1	791.3
1985	693.8	41.1	[R] 75.4	7.8	818.0
1986	[PJ] 701.1	[PJ] 39.5	[PJ] 76.8	[PJ] 7.8	[PJ] 825.3
1987	[PJ] 719.0	[PJ] 40.0	[PJ] 76.0	[PJ] 7.0	[PJ] 842.0
1988	[PJ] 728.0	[PJ] 39.0	[PJ] 78.0	[PJ] 7.0	[PJ] 853.0
1989	[PJ] 742.0	[PJ] 38.0	[PJ] 81.0	[PJ] 7.0	[PJ] 867.0
1990	[PJ] 764.0	[PJ] 37.0	[PJ] 83.0	[PJ] 7.0	[PJ] 891.0
1995	[PJ] 882.0	[PJ] 32.0	[PJ] 87.0	[PJ] 7.0	[PJ] 1,008.0

[PJ] Projection.

[R] Revised.

Note: Small amounts of bituminous coal and lignite consumed by the Transportation sector are included in the Other Industrial category. Total may not equal sum of components because of independent rounding.

Sources: Energy Information Administration, *Annual Energy Review 1984*; *Annual Energy Outlook 1985*, and *Short-Term Energy Outlook* (April 1986).

Mr. Traficant. Thank you.

Before we move on, I would like to relinquish the chair to my senior, Mr. Boucher, from Virginia.

Mr. Boucher [presiding]. We will be happy to hear at this time from Mr. Pete Smith, from Southwestern Public Service.

Mr. Smith, we will be glad to receive your testimony. Without objection, your prepared statement will be made a part of the record.

STATEMENT OF ALBERT A. SMITH, DIRECTOR OF PLANT DESIGN, SOUTHWESTERN PUBLIC SERVICE CO.

Mr. Smith. Thank you. Mr. Chairman, members of the committee, as one of the bridesmaids on the DOE's list, and on behalf of Southwestern Public Service, I want to thank you for inviting us to appear in this hearing.

Let me tell you a little bit about Southwestern Public Service Co. We are a medium-size electric utility headquartered in Amarillo, TX. We serve 350,000 customers in a 54,000-square-mile area consisting of the Texas and Oklahoma panhandles, a piece of Kansas, and the eastern portion of New Mexico.

One of the things that we feel makes us unique is that we are one of the very few electric utilities with the inhouse capability to design from a clean sheet of paper powerplants.

Since 1952, the department which I lead has designed every megawatt of Southwestern's generating capability. And since 1973, we have designed over 2,200 megawatts of coal-fueled generation at two locations, with five total units. These two powerplants are Harrington Station and Tolk Station. We have onboard inhouse a full-service staff of engineers, drafters, and other professionals capable of engineering fossil fuel powerplants which represents over 800 man-years of experience.

I would like to tell you something about our proposal. SPS proposes to repower one of our existing natural gas-fueled units. We have been working on the concept of converting one of our newer gas-fueled units to coal for years. We began serious study of converting our Nichols unit 3 plant to coal in 1984. The DOE's request for statements of interest for the clean coal technology program brought this study to a conclusion.

Let me tell you why conversion of Nichols 3 to coal via CFB technology is such a natural. We are 1 mile from our existing Harrington Station. That's a plant that has full capabilities for fuel delivery, which eliminates one potentially costly item from the retrofit of a gas-fueled unit. Nichols 3 is a 1968-vintage machine. There is at least 20 years of turbine generator life, and possibly much more, in that machine. The Nichols 3 size is a popular size. Demonstration of CFB technology at 250 megawatts will kick loose a host of other retrofit candidates.

This project is absolutely the next evolutionary step in CFB's. They are running at 95 megawatts, being built for operation in 1987 at 110 megawatts, being certificated commercially at 150 megawatts, and are ready for demonstration in 1990 at 250 megawatts. Of all the technologies proposed in this solicitation, CFB, in my opinion, represents the single most viable candidate for real cost competitiveness and commercialization in 1990, a year which I believe will mark the disappearance of the natural gas surplus bubble, if it doesn't disappear sooner.

Another reason that the Nichols 3 project is such a natural is the inhouse design capability of Southwestern. While other architect-engineers have more name recognition, Southwestern, through its engineering subsidiary, Utility Engineering Corp., has accomplished striking results by doing its own work.

Our last accomplishment, Roy Tolk Station unit 2, online 2 months ahead of schedule, 550 megawatts, coal was commercialized with construction interest at $510 per gross kilowatt. With a station power of 5 percent or less, with the latest control hardware, with an inhouse design bag house and cooling tower, and featuring totally enclosed construction, this plant rates second to none in layout, ease of maintenance, availability, and performance.

We believe that this price of $510 per kilowatt approximates one-half of the national average price for coal plants built in comparable periods. It is the experience that designed this plant which Southwestern intends to bring to the Nichols 3 CFB conversion.

Another reason for Nichols being a natural is the simplicity of the layout at the plant. It makes it a natural for conversion to coal utilizing a CFB boiler. It is less than 1 mile from an operating coal facility. It's set on the wide-open plains of the Texas panhandle. There are no major interferences: flat ground, unobstructed.

Our community wants the project. It is seen as a boon to the area, not a bane. And perhaps last, Southwestern's economic evaluations indicate that with currently priced coal and gas costs, the project provides a reasonable return with or without Federal cost sharing. This is not to say that we do not seek clean coal technology funds. We do. And we sincerely believe that Southwestern has demonstrated through its past construction programs the frugality we have exercised in bringing online a quality product at a reasonable cost.

How do I view the distribution of the project awards? How do I view the DOE's selection of the nine finalists? First, as an engineer who for 20 years has been involved with equipment selection, technical alternatives, and sometimes fuzzy economic choices, I appreciate the work that went into the review board's evaluation. They had a tough job to do and, from all appearances, did it professionally and expeditiously.

Am I disappointed? Yes; while all the projects selected have various arguable merits, I am disappointed that at least one of the finalists is not a CFB at the proposed size. In my view, CFB technology is absolutely the next step in the evolutionary chain of combusting coal in an environmentally acceptable manner. Successful construction and operation of a CFB at the nominal 250-megawatt size will literally open that option for dozens of fuel conversions or emissions-satisfying applications in the early 1990's.

To expect the average utility on its own and without some Federal or other cost sharing to take this step is unrealistic. Yet, the technology is ready to be applied at this size and the step must and will be taken by somebody.

Southwestern, with its Nichols 3 CFB repowering project, missed the first cut. We believe generally that a CFB retrofit at the nominal size of 250 megawatts should have been included, but defer to the review board's hard work and judgment.

Generally, we believe the allocations should also have favored projects with more near-term commercial viability. Our project, we believe, fits that description, and we trust that, should one or more of the nine finalists fail to reach an agreement with DOE or should additional clean coal technology moneys become available, less esoteric and more intermediate-term, commercially practical concepts will be chosen.

Thank you for allowing Southwestern to express its views on the Clean Coal Technology Project.

[The prepared statement plus answers to questions asked of Mr. Smith by Mr. Hall follow:]

TESTIMONY OF
ALBERT A. SMITH
ON BEHALF OF
SOUTHWESTERN PUBLIC SERVICE COMPANY
BEFORE THE
UNITED STATES HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATION

SEPTEMBER 11, 1986

Mr. Chairman, members of the Committee, my name is Albert A. Smith. I am Director of Generation Plant Design and Construction for Southwestern Public Service Company ("SPS"). I am a graduate of Texas Tech University School of Engineering and am a registered Professional Engineer in the State of Texas. The department I lead is responsible for design and construction of SPS's power plants as well as additions and modifications to SPS's existing power plant facilities.

On behalf of the SPS, I am grateful for the opportunity to express the Company's views on the Department of Energy's Clean Coal Technology Program as well as describe the Project for which we had submitted an application for funding for this program.

Company Overview

Southwestern Public Service Company is an investor-owned electric generation, transmission and distribution utility. It is engaged in the sale of electricity in a 52,000 square mile area in the South Plains of Texas, the Texas and Oklahoma panhandles, southwestern Kansas, and southeastern and eastern New Mexico (refer to Exhibit 1.1 for a map illustrating SPS's service area). Farming, ranching, cattle feeding, electronics, and the production of oil and natural gas are important factors in the economy of SPS's territory.

SPS is a New Mexico corporation, regulated by the municipalities that it serves in Texas, by the Public Utility Commission of Texas ("PUCT"), the New Mexico Public Service Commission, the Corporation Commissions of Oklahoma and Kansas, and the Federal Energy Regulatory Commission.

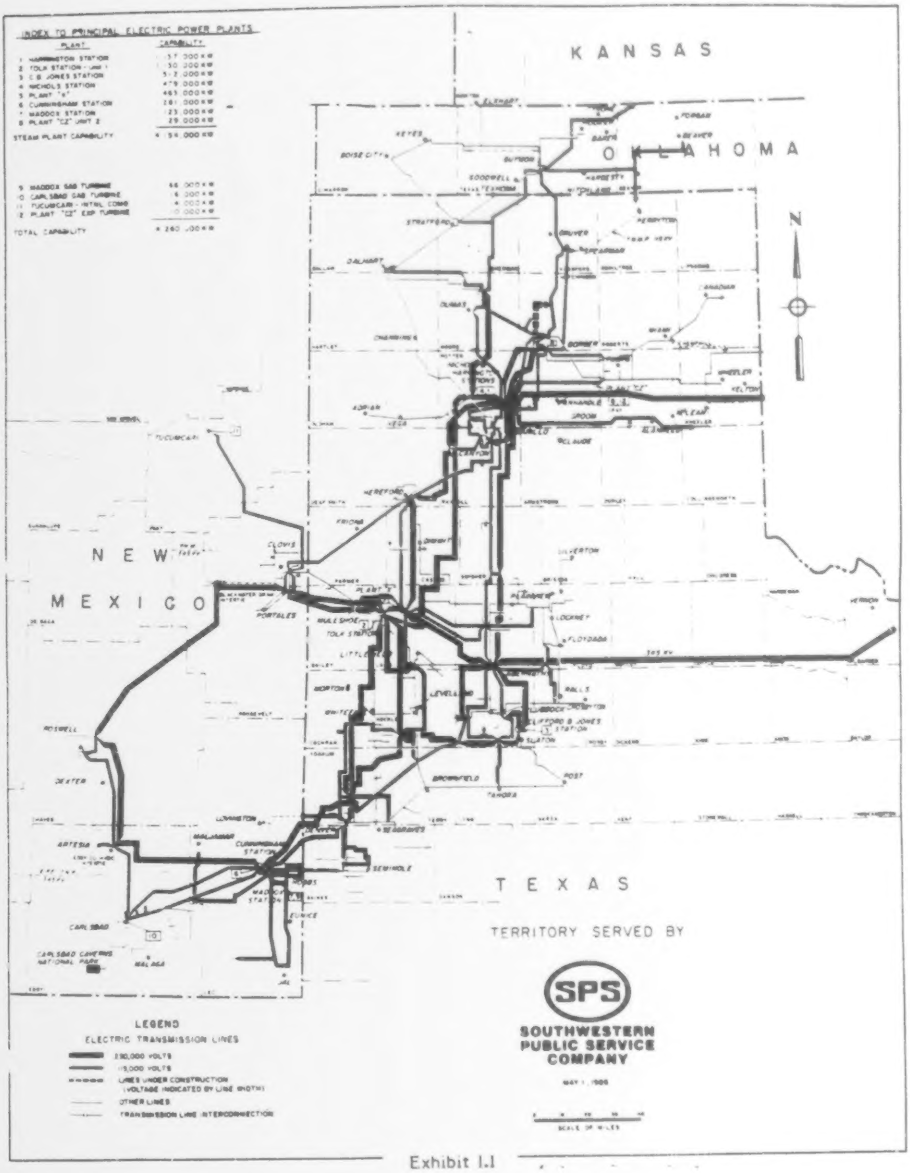

INDEX TO PRINCIPAL ELECTRIC POWER PLANTS
PLANT
CAPABILITY
1 HARRINGTON STATION 1,137,000 KW
2 TOLK STATION - UNIT 1 1,130,000 KW
3 C.B. JONES STATION 512,000 KW
4 NICHOLS STATION 479,000 KW
5 PLANT "X" 463,000 KW
6 CUNNINGHAM STATION 281,000 KW
7 MADDOX STATION 123,000 KW
8 PLANT "CZ" UNIT 2 29,000 KW
STEAM PLANT CAPABILITY 4,154,000 KW
9 MADDOX GAS TURBINE 66,000 KW
10 CARLSBAD GAS TURBINE 16,000 KW
11 TUCUMCARI - INTRNL COMB 14,000 KW
12 PLANT "CZ" EXP TURBINE 10,000 KW
TOTAL CAPABILITY 4,260,000 KW
KANSAS
OKLAHOMA
NEW MEXICO
TEXAS
N
TUCUMCARI
CLOVIS
PORTALES
ROSWELL
DEXTER
ARTESIA
CARLSBAD
CARLSBAD CAVERNS NATIONAL PARK
MALAGA
HOBBS
EUNICE
JAL
CUNNINGHAM STATION
MADDOX STATION
SEMINOLE
SEAGRAVES
BROWNFIELD
TAHOKA
POST
SLATON
CLIFFORD B. JONES STATION
LUBBOCK
LEVELLAND
LITTLEFIELD
MULESHOE
TOLK STATION
PLANT X
PLAINVIEW
LOCKNEY
FLOYDADA
SILVERTON
DIMMITT
FRIONA
HEREFORD
CANYON
AMARILLO
CLAUDE
VEGA
ADRIAN
PANHANDLE
GROOM
McLEAN
ALANREED
SHAMROCK
WHEELER
KELTON
PLANT "CZ"
BORGER
DUMAS
DALHART
STRATFORD
SPEARMAN
GRUVER
PERRYTON
BOOKER
GUYMON
HOOKER
BEAVER
FORGAN
BOISE CITY
KEYES
ELKHART
VERNON
345 KV
LEGEND
ELECTRIC TRANSMISSION LINES
230,000 VOLTS
115,000 VOLTS
LINES UNDER CONSTRUCTION (VOLTAGE INDICATED BY LINE WIDTH)
OTHER LINES
TRANSMISSION LINE INTERCONNECTION
TERRITORY SERVED BY
SPS
SOUTHWESTERN PUBLIC SERVICE COMPANY
MAY 1, 1980
SCALE OF MILES

Exhibit I.1

At the end of fiscal year 1985, SPS served 349,407 customers which resulted in a customer density of 6.7 customers per square mile. Residential customers comprise 82% of this total, commercial customers 15%, and industrial, municipal and wholesale customers 3%. SPS has eight steam plants and four diesel and gas turbine sites with a combined generating capability of 4,260,000 kilowatts; 2,267,000 kilowatts in five units are coal-fueled, 1,883,000 kilowatts are fueled by natural gas, and 110,000 kilowatts of capacity use other fuels. SPS designs, constructs, operates and maintains its power plants. The Company has no nuclear generation.

The power plants are interconnected by more than 1,000 miles of 230,000 volt transmission lines. Over 4,000 miles of other transmission lines augment the "backbone" system. SPS is connected to, and is a member of, the Southwest Power Pool ("SPP").

A 200 MW high voltage direct-current ("HVDC") interconnection linking El Paso Electric Company and Texas-New Mexico Power Company to SPS was placed in service near Artesia, New Mexico, on September 21, 1984. This intertie was the nation's second tie between the eastern and western electrical grids and was designed, constructed, and is maintained by SPS personnel. Another HVDC interconnection, also with 200 MW capacity, near Clovis, New Mexico, connects SPS with Public Service Company of New Mexico. It was placed in service January 1, 1985. These two HVDC ties provide the vast majority of interconnect capability between the eastern and western electrical grids of the United States.

In 1973, SPS began construction of its first coal-fueled unit. This unit, Harrington Station Unit 1, came on line in 1976, and the second and third units came on line in 1978 and 1980, respectively. The first unit at a second coal-fueled plant, Tolk Station, was brought on line in 1982 and a second unit at Tolk came on line in 1985. These five coal units were designed and constructed by SPS's Generation and Plant Design Department, which will provide the design and construction of the facilities proposed to the DOE.

In fiscal 1985, approximately 65% of SPS's generation was from plants fueled by low-sulfur, Western coal. In 1986, coal-fueled plants are expected to provide approximately 76% of total generation. This increase is attributable to the completion of the coal-fueled Tolk Station Unit No. 2 in June 1985 and to the renegotiation of natural gas supply agreements, which significantly lowered natural gas take-or-pay requirements. Lower take-or-pay requirements permit SPS to produce a greater proportion of its generation at coal-fueled power plants. With no new generating units being added to the SPS system through 1995, at the current projected load growth, the fuel mix in 1990 would fall to 68% coal and to 59% coal in 1996 without the proposed Project. With the Project proposed to DOE, these percentages become 75% and 66%, respectively.

The average cost of SPS-constructed coal-fueled plants placed in service through 1980 was $302 per kW. The installed cost of the last unit at Harrington Station completed in 1980, Harrington Station Unit 3, was $345 per kW. The cost of comparable coal-fueled plants completed during the 1979-1980 period by other utility companies averaged $600 per kW according to the November, 1981 issue of Electrical

World. The 1982 Tolk Station Unit 1 cost $493 per kW and the installed cost of the 1985 Tolk Station Unit 2 was $510 per kW. Reddy Communications, Inc., a utility research firm, reports the national average cost of building coal-fueled power plants from 1980 to 1984 was $1,100 per kW. Furthermore, they project this cost to rise to $1,535 per kW for such facilities between 1985 and 1991. The Project proposed to DOE would cost approximately $400 per kW to convert to coal capability in place of gas capability. As a consequence of SPS's ability to build these plants at a lower cost, other utilities have consulted with SPS in an effort to achieve some of SPS's economies.

Technology Experience

The Company is noted in the industry as an innovator. Among its accomplishments are:

A. SPS was the first utility in the nation to use municipal sewage effluent for plant cooling. SPS has "written the book" on the use and management of this once-wasted resource. It currently has 2,128,000 kW of generation cooled with this product.

B. SPS was the first utility to apply electrically adjustable frequency ("A/F") drivers to fan service on a new utility boiler, resulting in significant savings of station power and fuel. With the start up of its Tolk Station Unit 1 in 1982, SPS began operation of 24,000 Hp of A/F equipment. Tolk Station Unit 2, is similarly equipped. The station operates with approximately 5% station power, one of the lowest station power consumptions for a coal-fired power plant in the nation.

C. SPS placed into service the world's first digital turbine-generator controller when Jones Station Unit I went into service in 1971. In 1980, SPS completed the installation of one of the first -- and still one of the few -- digitally based, boiler-turbine coordinated control systems at Harrington Station Unit 3, SPS's first totally computer-controlled facility. Tolk Station Units 1 and 2 are equipped with subsequent versions of these digital control systems.

D. SPS was the first utility to apply the removal of particulates by fabric filters on a new utility-size boiler. This "first" was accomplished with the start up of Harrington Station Unit 2 in 1978. Since that pioneering effort, all of SPS's new units have been similarly equipped. Tolk Station Unit 2 uses a reverse-air fabric filter designed total in-house.

E. The EPA's existing standard for particulate emissions for coal-fueled power plants is based on data provided by SPS. This was accomplished when, under contract to the EPA, SPS characterized the emissions for the Harrington Station Unit 2 fabric filter. Other joint EPA-SPS particulate collection work has been performed over the past five years in a small, two-compartment, side-stream fabric filter adjacent to the Harrington Station Unit 2 fabric filter.

F. SPS is designing in-house and fabricating its own mechanical draft cooling towers. The cooling tower placed in service with the commissioning of Tolk Station Unit 2 was the third tower so designed and the second tower so fabricated.

G. In 1982 SPS installed the first continuous bottom-ash removal system to be placed in service on a utility boiler in the United States. It was installed at Tolk Station Unit 1. A similar unit is in service on Tolk Station Unit 2, and similar units have since been retrofitted on SPS's three units at Harrington Station. These systems help conserve one of our area's most scarce resources -- water, as well as lowering the maintenance costs borne by our ratepayers.

H. SPS has been able to market all of the ash products from the Wyoming coal burned at its Harrington and Tolk Stations. The ash is used in structural concrete, oil-well cement, as a road-base material to "top out" asphalt highways, and as a road de-icer. Some of the Tolk Station flyash is shipped by rail as far as California. The successful marketing of this otherwise burdensome power plant product is the best possible solution to its disposal.

Proposed Project

Specifically, SPS has proposed to the Department of Energy to repower its 250 MW (nominal) Nichols Station Unit 3 ("Nichols 3") by adding, adjacent to the existing gas-fueled reheat boiler, a Circulating Fluidized Bed ("CFB") reheat boiler. Nichols Station, a three unit electric generating plant, is located in Potter County, Texas, eight miles northeast of Amarillo, Texas and is connected to SPS's transmission and distribution system. The proposed Project is designed to lower the cost of electricity to SPS's customers and to demonstrate the economical, technical and commercial practicability at the proposed site of an age-old coal-burning boiler technology, CFB.

This proposal involves the direct fuel conversion of the Nichols 3 steam requirements from natural gas fueled to coal fueled and is not a capacity addition to SPS's system. The existing turbine-generator equipment will not be altered, and the existing gas boiler will be retained.

The use of lower-cost coal at Nichols 3 will reduce the net cost of electricity from the Nichols 3 generator. The CFB boiler combines three new and desirable operating features: in-furnace sulfur removal, fuel-source flexibility, and minimal oxides of nitrogen (NOx) generation. The oxides of sulfur (SOx), released when coal is burned, are captured in the CFB boiler furnace, unlike traditionally designed coal-fueled boilers that require expensive external desulfurization systems, known as scrubbers, to satisfy emissions standards. Limestone is injected into the CFB boiler furnace and reacts with the SOx to form gypsum, an inert and useful mineral.

The generation of NOx is temperature dependent. More commonly used coal combusting techniques have trouble meeting current environmental regulations since they operate at furnace temperatures in excess of 2500°F. The CFB is designed to operate between 1550° and 1600°F to facilitate the in-furnace sulfur capture. In theory, virtually no NOx is generated at CFB operating temperatures.

The CFB's second major advantage, fuel flexibility, permits more competitive fuel sourcing. SPS will be able to further decrease its reliance on natural gas and use lower-cost coal to generate electricity for its customers. The primary coals planned for this project are from

New Mexico and Wyoming. The CFB boiler permits the use of even lower grade solid-fuels, as can be found closer to SPS's territory, that would be unacceptable in a pulverized coal ("PC") boiler. This fuel sourcing flexibility enhances SPS's negotiating leverage with both fuel suppliers and transporters. SPS's customers reap the benefits. CFB boilers also incur lower operating and maintenance expenses than do PC boilers, since they do not use coal mills nor require a scrubber.

The SPS plant design group, sited above, is experienced with the coal technology proposed to be used in conjunction with the Nichols 3 project, and is currently serving as architect-engineer for the Texas-New Mexico Power Company proposed CFB coal-fueled generating units to be built in central Texas.

The Nichols 3 CFB boiler project will enable the development of major clean coal technologies in Texas on a utility-size scale and demonstrate that CFB technology will economically compete with PC coal-fueled boiler designs in the generation of electric energy, and the control of sulfur oxide and nitrogen oxide emissions.

SPS has planned an ambitious schedule for the proposed CFB boiler repowering project so that it can achieve benefits for its ratepayers in a timely fashion and acquire necessary equipment from vendors during a period of favorable prices due to a depressed construction market. SPS's current plans are to begin acquiring equipment in January, 1987 and to begin construction in August of the same year. Completion of the project is planned for May, 1990 requiring that the existing generator be synchronized with SPS's system in January, 1990, powered by the new coal-fueled CFB boiler. This schedule was developed to bring the existing generator online before the peak of 1990 and to achieve fuel cost savings to ratepayers in a timely manner. The projected savings in the first full year are $13.8 million. These savings will not be achieved unless the proposed schedule is adopted.

SPS submitted the Nichols 3 Project to the Department of Energy in response to DOE's Project Opportunity Notice (PON) PE-PS01-86FE60966 for a variety of reasons. A combined DOE-SPS venture would satisfy the mission of DOE's "Clean Coal Technology Program" by demonstrating an alternate approach to emission control for a wide range of boilers.

Because the Project is a demonstration rather than a research and development project, the conclusion of the Project would result in an immediately available, economically and technically practical coal-fueled steam generator alternative for the electric utility industry. As both a utility and a generating plant designer, SPS has the unique ability to know what is required to adopt a Clean Coal Technology to a utility's needs, and at the same time, have the ability to expeditiously design and complete the project. Demonstrating the efficacy of CFB technology in a true electric utility application would minimize the reservations of this traditionally conservative industry. As the temporary glut in the gas fuel market wanes, CFB boilers, fueled with more stable-priced coal, would provide an attractive alternative to gas. This fuel cost savings to our ratepayers is seen specifically as a benefit for SPS undertaking the Project. Over the term of the Project, the fuel savings will be approximately $518.0 million. The net savings to SPS's ratepayers will be approximately $178.0 million. As the excess in electrical generating capacity currently being experienced by some utilities is absorbed, the economic benefits of CFB boilers could render obsolete PC boilers with their requisite high maintenance sulfur-scrubbers.

The availability of CFB technology to coal users would benefit the U.S. coal industry, particularly by making available currently impractical resources such as higher sulfur coals and coal containing mine refuse.

Clean Coal Technology Program

DOE has done a monumental amount of work in completing the selection of the final Clean Coal Technology projects from such a diverse range of alternatives and has done so in a timely fashion. Technologies such as Pressurized Fluidized Bed combustion hold long term environmental and economic promise. If PFB's can solve the gas cleanup problems associated with that technology, PFB's could become the ultimate evolution of the CFB. In view of the past experiences with coal gasification, SPS hopes DOE has critically reviewed the ultimate commercial competitiveness before continuing to fund such development projects.

Obviously, SPS would like to have been selected in the current round of projects. Retrofit or repowering projects such as the Nichols 3 Project would satisfy the timely nature in which the development of commercially practical Clean Coal Technologies were mandated by Congress. Assuming that the presently selected projects are viable, future funding of retrofit projects that hold promise but need support in order to reach competitive commercial status is definitely warranted.

Looking ahead, SPS is investigating alternate ways of completing the Project. This effort on the part of SPS should not be construed as disinterest in future joint participation with the DOE on such an important national issue as Clean Coal Technology. The promise of the Nichols 3 Project has not diminished since the submittal for the Project proposal to the DOE, and SPS believes that the potential benefits of CFB technology should be proven.

Albert A. Smith
Director, Generation Plant Design and
Construction
Southwestern Public Service Company

RESPONSE OF MR. ALBERT A. (PETE) SMITH
DIRECTOR OF GENERATION PLANT DESIGN AND CONSTRUCTION
SOUTHWESTERN PUBLIC SERVICE COMPANY
TO QUESTIONS FROM CONGRESSMAN RALPH HALL
4TH CONGRESSIONAL DISTRICT OF TEXAS
SEPTEMBER 16, 1986

1. On page 4 of your statement you say that your last power plant, completed in 1985 was completed for $510 per kilowatt of capacity and that other similarly sized plants were being completed about the same time for more than $1000. What's the secret of your success? How can you bring these plant in so much below prevailing industry costs?

ANSWER

There are four major contributors to Southwestern Public Service Company's ("SPS") lower plant costs:

1. By designing our generating stations "in-house" with our own design and construction management team, we eliminate middle men and reduce lead time. In contrast, all but a few utilities retain an architect-engineering ("A&E") firm to perform this task, creating a double-edged liability. If the utility allows the A&E free rein to design the plant, they typically end up with a plant that does not totally fit the utility's operating requirements and is difficult to maintain. Conversely, if the utility chooses to review the A&E's work, additional manpower and time are required.

2. Our design engineers are allowed "one-on-one" contact with our suppliers and do their own purchasing. This reduces costly misunderstandings, expedites vendor selection, and streamlines subsequent project coordination.

3. Our plant construction benefits from our location in the Southwest. The high productivity of the work force in our territory reduces both the number of people and time required to construct the plant.

4. Our construction management team quickly resolves the day-to-day questions without having to waste time seeking approval of their decisions. This quick response capability plus the time savings noted above help to minimize the considerable amount of interest accrued during the construction of a generating unit.

2. On page 7, you say that this circulating fluidized bed boiler (CFB) proposed for the Nichols 3 project will produce an economical way to remove sulfur dioxide (SO_2) and that the unit will have very low nitrous oxide (NO_x) emissions. Do you think CFB's are a quickly achievable retrofit technology if they can be demonstrated on large scale boilers?

ANSWER

CFB boilers are operating in commercial applications as large as 80 MWe. Demonstrating CFB technology in a large scale utility boiler installation is all that is lacking in proving the technical and commercial capability of CFB boilers for the majority of utility applications. The incentive to replace an existing steam supply system would then depend on stimuli such as fuel cost savings through fuel conversion or fuel sourcing flexibility, the ability to increase generating capacity through the use of a topping cycle, or the need to achieve lower NO_x and SO_2 emission rates.

3. On page 9, you state that there is a $13.8 million fuel cost savings in the difference between burning gas and coal in the first full year of the operation of the project and an estimated savings of nearly $180 million over the life of the project. With gas cost as low as they are today and perhaps even going lower, how do you plan to save money burning coal? Do you think the Texas PUC should issue the necessary certificates authorizing you to build the Nichols 3 project if these fuel costs and reduced air emissions can be achieved?

ANSWER

Gas prices are currently very low relative to past prices and predictions. It is also true that these low prices in many cases cannot support and have curtailed gas exploration, guaranteeing a short duration of these low prices. In the three years required to install the CFB boiler, the likelihood of gas prices significantly increasing is great. This short-term situation, along with the traditional volatility of the gas industry and the longer term availability of coal, favor the long life capability of utility scale generators. SPS believes that the fuel savings are achievable and that the Nichols 3 CFB Repowering Project warrants the endorsement of the Texas Public Utility Commission.

Mr. BOUCHER. Thank you very much, Mr. Smith.

Our next witness is Dr. Richard Wolfe, vice president for research and development, United Coal Co., a company which, I might add on a point of personal privilege, is one of the industry leaders in research and development for clean coal technologies, and I am quite pleased that he is with us here today.

Mr. SENSENBRENNER. Will the gentleman yield?

Mr. BOUCHER. I will be glad to yield to my colleague from Wisconsin.

Mr. SENSENBRENNER. I kind of wish that when the gentleman from Virginia is taking his colleagues down to show what a great job this company does, he would allow some Republicans to come along. [Laughter.]

Mr. BOUCHER. You will be on the next trip, I can assure you.

Dr. Wolfe, we will be happy to hear from you.

STATEMENT OF RICHARD A. WOLFE, EXECUTIVE VICE PRESIDENT FOR RESEARCH AND DEVELOPMENT, UNITED COAL CO.

Mr. WOLFE. Thank you very much. It certainly is a privilege for me to be here. Being the only representative of a coal-producing company at these hearings, I feel very compelled to give you a perspective from a coal company standpoint with regard to the clean coal technology. Certainly, that perspective is different than from the equipment manufacturers or other areas that are involved here from the utilities. Our major interest in clean coal technology is increased markets for coal. The major problem that is facing the coal industry today is that we do not have enough markets for coal, and certainly it seems like the clean-coal technology is concentrated mostly in the area of utility utilization, of burning of coal.

Let me just emphasize that that is not the only use of coal, and that is not the only need for this country with regard to energy uses. We need transportation fuels just as badly as we need electricity. Imported oil is ever-increasing. We cannot forget about that with regard to clean-coal technology awards.

I certainly feel compelled to point out that in the selection of the nine awards, six of the nine awards were related to emission controls, which don't really add to greater coal utilization or new markets for coal. Only one project would contribute to developing a new market, and that is the Ohio Ontario coprocessing project, which would get coal into a liquid form.

We as a coal company, and wanting to use more and more coal, and when there is unemployment in the coalfields and millions of tons of coal, low-sulfur coal, sitting on the ground, ready for taking to wherever the markets may exist, it certainly, from our standpoint, our objective is to increase coal's use and use it in its best form.

It was mentioned already this morning that some of the high-sulfur coals, most of the funding that has been developed here is related to the applications of the technologies of scrubbing or emission controls of high-sulfur coal. That doesn't necessarily increase coal's use in the energy picture of this country.

Basically, Mr. Chairman, I would like to just point out that the project that United Coal Co. did submit was probably the best example of the 51 selected—or submitted for the coal company and the environmental community could relate to increased benefits for coal, and that is cleaning coal of its sulfur and its impurities before it's ever burned. To me that makes far more sense, and less cost, to clean the sulfur and the impurities from the coal before it's ever shipped, and then you don't have to be concerned about all these greatly costly projects with regard to off-gas cleaning.

It does provide coal a flexibility to get into a number of different markets if you concentrate in the coal-cleaning area. We were very disappointed that no projects selected were related to coal cleaning ahead of precombustion.

The project we submitted was a very small project. We did not ask other people to be part of it. It was only a $5 million project. We thought that that would stand out among all projects as the best example of, within 2 years of commercializing a technology, to recover coal from waste ponds that are scattered throughout the coal regions of this country and recover low-cost coal that exists—and millions and millions of tons of this exists. So definitely, we were surprised. We didn't really quite understand the selection process that would ignore such a project.

With regard to the question that was asked me about the retrofit and the available money, I would just like to point out that if we do have additional money that's going to be allocated with Congress, that we talk about and think about additional coal markets and coal utilization, rather than just being able to burn coal cleaner and cleaner at lower and lower emissions.

For example, the coal companies, coal can be into the locomotive market. I think there is an area that we could concentrate, converting coal into a liquid diesel fuel. We've already done some of that under the mild gasification project that Congress has supported through the DOE.

We think that there is a real opportunity to increase 50 to 75 million additional tons of coal to be used in the locomotive industry to replace imported oil in diesels. To me, those are the kinds of projects that I would think would be more beneficial to Congress with regard to the Retrofit Program. Certainly, backing out oil using coal-oil mixtures or liquid coal makes far more sense to me than conditional retrofit programs.

So basically, I would just like to emphasize that if we do have additional money, that we do talk about coal utilization and new markets for coal. Thank you.

[The prepared statement of Dr. Wolfe follows:]

INVITED TESTIMONY BEFORE THE U.S. HOUSE OF REPRESENTATIVES SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

SEPTEMBER 11, 1986

DR. RICHARD A. WOLFE
EXECUTIVE VICE PRESIDENT, UCC RESEARCH CORPORATION
UNITED COAL COMPANY
BRISTOL, VIRGINIA

Mr. Chairman and distinguished members of the Subcommittee, it is my pleasure to have this opportunity to address this subcommittee.

The subject of clean coal technology is so important to this nation and the coal industry that what we say and do here can affect the future of energy utilization in this country. The coal industry is experiencing one of the most difficult times in it's history. Thousands of miners are unemployed, mines are being shut-down, support industries are moving out of the coal fields, and at the same time, this country daily is becoming more and more dependent upon imported oil. The Clean Coal Technology Program is important, but only important if the money is spent wisely, to allow coal to be used in an efficient and environmentally acceptable manner and contribute to reducing our dependency upon imported oil.

As I mentioned in previous testimony to this same Subcommittee in March, 1984, let's not "kid ourself" that our ever increasing dependency upon imported oil is not having a devastating impact upon this country's ability to produce it's own energy. All you need to do is visit anywhere in the Appalachian coal fields or the oil fields in Texas. The use of imported oil, no matter what the cost, should be reduced. The Clean Coal Technology and Fossil Energy Programs are the vehicles by which we can develop and commercialize the technology necessary to reduce our import oil dependency.

I believe it is indeed appropriate to have these hearings now that the first nine projects have been awarded and I commend this Subcommittee for taking this initiative. Our best learning experience comes from immediate assessment of what we have just completed and, so it is, with the Clean Coal Technology Solicitations.

I have had the privilege to have worked within the Federal Government (U.S. AEC, U.S. ERDA, and U.S. DOE) and within private industry during the past 25 years. I know how difficult it is to technically review 51 proposals and then make selections with regard to technical readiness and industrial seriousness when considering current Administration guidelines and political influence. My objective here is to give you my impressions of how the Clean Coal Technology program is seen by one representative of the coal industry, and provide some insight as to a recommended course for future solicitations.

Purpose of the Clean Coal Technology Program

Let us not forget that the Clean Coal Technology program was initially conceived as a means to provide the funding necessary to fill the gap established between the long range, high risk, laboratory type research currently being sponsored by the DOE and the need to commercialize some of the near-term technology that would have a positive impact on enhanced coal utilization. The response received from industry in the initial 51 proposals clearly confirms Congress' recognition of the need for this commercialization program. I am still not certain if this Administration has listened to this message, in that the proposed FY-87 coal research budget has continued to be reduced in relationship to the nuclear R&D and defense programs to its lowest levels ever. During the past several years, if it had not been for the added funding provided by Congress to the DOE coal research program, we just might not have any coal research program on which a Clean Coal Technology program could be based.

It is also my belief the guidelines for the type of projects acceptable within the Clean Coal Technology program was sufficiently broad to allow for a host of new and emerging coal technologies to be considered. This observation is one of the most important for it allows consideration of projects that will expand the markets and utilization of coal not just limiting the technology to finding a better way to burn the coal now being used.

I share the feelings of many other industry representatives in that this Administration appeared to have never really been behind this program. The requirements for the proposals were the most stringent of any solicitation ever requested from the DOE. Also, the change in pay back requirements for only those successful projects has doomed projects to become failures even before being initiated. With all the government regulations imposed on these projects, the pay back requirements and the inordinate cost involved in proposal preparation and negotiation, many in industry felt it would be less expensive for industry to fund the projects themselves without government participation. However, we all know, industry will not proceed on their own with these higher risk, first of a kind, projects without government's assistance in reducing that risk. So you see, the Administration's influence on the Clean Coal Technology program has, in my opinion, gone against the initial intent of Congress and the good wisdom of using taxpayer's funds to serve as a catalyst to accelerate the commercialization of Clean Coal Technology.

Projects Awarded for Negotiation

Before commenting on those projects selected for negotiation, I want to first re-emphasize the perception of most of us in the coal industry.

What the coal industry needs most of all now and in the future is to increase coal's utilization beyond those markets that currently exist. We, as an industry, can produce more coal than is currently being demanded. Millions of tons of coal are now lying in stockpiles throughout the U.S.A. The steel mills are being shut-down and using less coal because we are importing more steel. The utilities are not expanding and are now even turning back to imported oil. So the current coal markets have dwindled. What we need is new markets for coal and the development of technology that will lead to greater uses of coal.

Although the coal industry recognizes its need for less and less emissions from both oil and coal burning utilities, the industry's major concern is how to increase the markets for coal. Supplying a larger portion of the national energy needs is the priority interest of the coal industry. It is through this perspective that we have reviewed the nine projects awarded under the initial Clean Coal Technology Solicitation.

Of the nine projects selected, only one project involving coal-oil co-processing liquefaction proposed by Ohio Ontario Clean Fuels, Inc., has any hope of expanding the use of coal into a new market to replace oil. Six of the projects are directed toward emission reduction in the existing utility markets for using higher sulfur coals. No expanded use of coal will be the outcome here. The direct iron ore reduction project to replace coke oven/blast furnace technology proposed by Weirton Steel Corporation may lead to a lower cost method of steel making, thus reducing steel imports. But again while steel use throughout the world is on the decline, I doubt if any additional coal use will be the outcome and certainly not reduce our dependency upon imported oil. The last project involving underground gasification of steeply lying beds of subbituminous coal deposits of Wyoming makes the least sense of all in expanding the use of coal, particularly within the next twenty years. With billions of tons of easily accessible level beds of coal that have not currently been used, why bother with developing such a long-range technology at this time when so much short-term technology is needed by the coal industry.

So you see, when one walks the streets of a mining town such as Grundy, Virginia, as I did this past week, talking to unemployed miners, observing the millions of tons of coal in stockpiles so high they look like mountains from a distance, and knowing that there are billions of tons of low sulfur coal lying underground available for the asking, it does make one have a major concern as to the direction of these programs. The type of projects being funded within the Clean Coal Technology program and within the DOE's current coal research program will not make a contribution to increased coal usage in the next decade. This is difficult to explain to unemployed miners; particularly when one sees projects on the back-up list that can have an immediate contribution in the coal industry.

Three projects on the back-up list related to coal cleaning to remove sulfur and ash were not selected for funding. The removal of sulfur and other impurities in coal at the mine sites is a far more efficient and a lower cost method of providing clean coal than trying to catch the pollutants after they are transported great distances, and then burned at a utility. It is hard to understand the thinking of those reviewing these projects in not selecting at least one coal cleaning or coal preparation project. The demonstration of advanced coal preparation technology is drastically needed within the coal industry. For example, nearly 40-45 percent of the coal ore removed today from deep mines is rejected as waste primarily because coal cleaning technology is not sufficiently developed to allow for additional coal recovery. Such technology development and demonstration would immediately contribute to more efficient coal cleaning plants, lower coal cost to customers, and less coal waste for disposal in the environment. It is this type of technology development that would, in a short-term, benefit the coal industry, the customers and the environment.

With regard to other areas of technology demonstration that would be beneficial is the development of coal liquid type products such as coal-diesel type fuels, coal-gasoline type fuels, coal-water/coal-oil mixture fuels that directly replace oil at even lower emission levels. The locomotive market, once the primary coal market, was lost to diesel fuel in the 1950's. To regain such a market would contribute to the use of as much as 50-75 million additional tons of coal per year. The development of a coal-based locomotive fuel acceptable as a replacement for diesel fuel would assure that the goods that are vital to our national economy could move without interruption when the next oil shortage occurs. To me, when considering any additional government funding, it would be far better to set a goal of developing an acceptable coal-based liquid fuel as a substitution for diesel fuel used in locomotive engines and ships. The development of a high density coal based liquid fuel as a substitution for jet fuel in military applications is another area for new markets for coal. Russia already has developed a coal based high density fuel as the primary fuel for their high altitude MIG-25 bomber. It is more appropriate to the coal industry to emphasize new cleaner type coal liquid markets rather than continuing to retrofit existing facilities that do not necessarily contribute to increase coal usage. The only retrofit technologies that make sense to me are those related to using coal as a way to back out oil.

United Coal's Project Entitled, "Coal Waste Recovery - Advanced Technology Demonstration"

The project submitted by United Coal Company proposed to utilize a newly developed coal cleaning technology to recover clean coal from abandoned coal waste ponds. The total project cost was estimated at 4.88 million dollars of which UCC proposed to cost share 50 percent. Needless to say, we were surprised and disappointed that this project was not selected for it would have demonstrated within two years a technology to have allowed the coal industry to recover coal at a lower cost than can currently be mined and, at the same time, clean up the environment. The project was to have been located at the Moncle Refuse Disposal Impoundment in Logan County, West Virginia. This is one of the best examples to me of the type of projects that the coal industry and environmental community can relate with as to its direct benefits in a time frame that can have a positive impact upon the industry.

Summary Analysis of Additional Clean Coal Technology Funding

Government funding now and in the future is needed to accelerate the commercialization of coal utilization technology. The only way that coal can make a full contribution to the energy needs of this nation is through the development and commercialization of new coal technology.

Our energy needs are basically in two areas: producing electricity and providing transportation fuels. Coal should and can be converted to transportation fuel and not be limited to just being burned to make electricity. We should not forget that "Imported Oil Is Our National Villain." Imported oil contributes to our serious balance of payments problem, unemployment in energy fields, and a dangerous threat to our national security. We must not be lured into a false sense of security about oil; it is a depleating natural resource with a finite limit of availability. We need to develop coal as a liquid substitute in those industrial sectors now dependent upon oil. Coal produced liquids can be a substitute for imported oil in diesels and gasoline engines, industrial and utility boilers. Existing technology needs to be commercialized which will allow for enhanced coal utilization and the replacement of oil.

I believe Congress should consider funds for technology to replace oil with coal. This would be more beneficial than technology for retrofitting existing utilities. For example, developing a coal-based liquid fuel for diesel locomotive and high density fuels for military application would significantly increase the use of coal as a replacement for oil. Our national needs are new markets for coal and a reduction in imported oil.

Mr. **Boucher**. Thank you, Dr. Wolfe.

Mr. Stathoplos, we will be happy to hear from you.

STATEMENT OF ANTHONY STATHOPLOS, DIRECTOR, KREISINGER DEVELOPMENT LABORATORY, COMBUSTION ENGINEERING

Mr. **Stathoplos**. Mr. Chairman, committee members, ladies and gentlemen, I am Tony Stathoplos, representing Combustion Engineering's fossil power systems division. I am pleased to be here this morning to discuss Combustion Engineering's proposal and our perspective of the Clean Coal Program.

By way of background, Combustion Engineering has designed and built more than 500 coal-fired utility boilers operating in the States today. These represent more than 50 percent of our total domestic coal-fired utility generating capacity.

We strongly support the objectives of the Clean Coal Technology Program. As you are aware, the removal of pollutants from coal can be addressed in a pre- or post-combustion mode or during combustion. Today, the majority of pollutants are removed post-combustion, largely by precipitators and scrubbers.

Because coal is a very heterogeneous material, it is our belief that no single technical approach will have equal economic benefits for all coal types. Hence, we strongly urge that all technological avenues for coal cleaning, ranging from pre- to post-combustion modes, continue to be explored.

In reviewing the nine projects currently chosen to receive awards, we note that none of these address precombustion coal cleanup. Five projects propose cleanup during combustion through the use of sorbent injection in either suspension firing or fluidized bed combustion applications. Three of the nine involve coal gasification. This technology has good potential to convert coal to a clean gaseous fuel, but is not near term nor easily retrofittable.

None of the selected proposals entail precombustion cleanup. Our proposal addressed precombustion cleanup and, we believe, would redress the technological imbalance we believe currently exists.

Our proposal meets the full intent of Public Law 99-190 and is strongly supported by the Electric Power Research Institute, the electric utilities research arm.

Our program brings two important elements together; namely, the benefits of burning clean coal, and the processes for producing clean coal. Program results will allow coal users to make the required judgments vis-a-vis the economics of precleaning technology versus those used during and postcombustion modes.

Precombustion cleaning offers a near-term means of controlling potential pollutants by utilizing coal now in commercially operating equipment. Of the potential clean coal technologies available, precombustion cleaning provides the opportunity for broad applications, including easy retrofitability, capital savings in the plants, a supplement to existing scrubbers, widens coal procurement, and provides an opportunity for converting from oil to gas firing.

Improved and advanced coal-cleaning processes can reduce the sulfur content of many coals to levels conforming to environmental standards without requiring postcombustion desulfurization systems. Other types of coal may be cleaned to a point where significantly less costly desulfurization is required.

Further, ash removed during the precombustion cleaning process, which is generally conducted at mine sites, could be more easily and safely disposed of at the mine than at individual plants following combustion. While coal cleaning is expected to provide powerplant capital and operating cost savings, it's essential the user be able to confidently determine the economic tradeoff between these savings and the fuel-cleaning costs.

Although recent studies have indicated significant economic benefits associated with coal cleaning, data upon which the users can confidently base commercial decisions exists for only a very limited number of coals.

The key to commercialization is to enable the user to confidently make decisions based on firm technical and economic factors associated with their specific requirements. Our program was designed to develop the necessary information for these commercialization decisions and would demonstrate the benefits of conventional and advanced coal cleaning applications.

The project would provide inexpensive coal evaluation procedures, a validated coal quality effects cost model, and a data base that would allow utilities to evaluate the cost savings resulting from clean coal.

Coals for combustion characterization would be processed at the Electric Power Research Institute's existing coal cleaning test facility in Homer City, PA. There they would undergo extensive cleanability testing by conventional and advanced coal cleaning processes.

Coal candidates would be jointly selected by DOE and the Electric Power Research Institute to represent those having large reserves, large domestic reserves, widely used by utilities and which have good desulfurization potential.

Mr. **Boucher**. Mr. Stathoplos, without interrupting you too greatly here, I would encourage you, if you could, to summarize the balance of your statement. We have a very limited amount of time before the House commences voting, and we do have questions we would like to ask.

Mr. **Stathoplos**. OK. Our project would require approximately 36 months to complete. All of the coal cleaning process equipment and coal firing equipment are available and applicable right now. This project requires relatively modest financing, approximately $8 million of DOE funding and comparable private funding. It is our opinion that this program deserves support and funding at the earliest opportunity.

Mr. Chairman, this completes my statement. I would be happy to answer any questions. Thank you very much.

[The prepared statement of Mr. Stathoplos follows:]

Written Statement of

Anthony Stathoplos

Acting Vice President for Research & Development,
Fossil Power Systems, Combustion Engineering, Inc.

to the
Committee on Science and Technology

September 11, 1986

By way of background, Combustion Engineering is a New York Stock Exchange listed company with sales exceeding $\$3\text{x}10^9$ annually. We are the free world's leading designer and manufacturer of coal-fired boilers for both industrial and utility use. There are currently more than 500 Combustion Engineering designed coal-fired utility boilers operating in the U.S.which represents more than 50% of total coal-fired generating capacity. The United States utility industry is the largest domestic consumer of coal, burning $700\text{x}10^6$ tons annually or in excess of 80% of the total coal burned.

Combustion Engineering supports the objectives of the Clean Coal Technology program which will contribute to the continued use of our most abundant fossil fuel in an environmentally acceptable manner. As you are aware, the removal of pollutants from coal can be addressed by pre-combustion, during combustion or post-combustion modes. Today, the majority of pollutants are removed post-combustion by precipitators and wet scrubbers. Because coal is a widely heterogeneous material it is our belief that no single technical approach will have equal economic benefits for all coal types. Hence, we strongly urge that technologies addressing all avenues ranging from pre- to post-combustion continue to be explored.

In reviewing the nine projects currently chosen to receive project awards, we note that none of these address pre-combustion coal cleanup. Five projects propose clean-up during combustion through the use of sorbent injection in either suspension firing or fluidized bed combustion applications. While we believe sorbent injection to be a viable, near-term, retrofittable technology we think the bias toward this technology has precluded exploration of other concepts which should also receive attention. Sorbent injection technology is also currently receiving support from the Environmental Protection Agency, Electric Power Research Institute, and Gas Research Institute.

Three of the nine projects involve coal gasification. Although coal gasification has the potential to convert coal to a clean fuel one must recognize that this technology is not near-term nor easily retrofittable. Additionally, with gasification concepts there must still be a post gasification sulfur removal step. We believe, then, that there has been an overbalance of post combustion cleanup concepts with no inclusion of pre-combustion cleanup concepts.

We believe our proposed clean coal project which entails pre-combustion cleanup would address the imbalance noted above. Our proposal meets the full intent of Public Law 99-190 and is strongly supported by the Electric Power Research Institute, the electric utilities' research arm. Our program brings two very important elements together, namely the benefits of burning cleaned coal and the processes for producing cleaned coal. Program results allow coal users to make the required judgements vis-a-vis the economics of pre-cleaning technology versus those during and post-combustion.

Pre-combustion cleaning offers a near-term means of controlling potential pollutants by utilizing coal now in commercially operating equipment. Of the potential clean coal technologies available, pre-combustion cleaning provides the opportunity for the broadest applications. These include:

1) a retrofit approach for sulfur reduction in existing coal-fired plants,
2) a capital savings approach for new plants,
3) a supplement to plants with scrubbers or in combination with sorbent injection,
4) an approach to widen coal procurement options,
5) an aid for potential conversions from oil to coal firing.

Although a significant quantity of the coals mined in the United States are now cleaned to some degree before firing, for many of these coals the residual sulfur content requires users to install sulfur removal systems and the residual ash can create operational and maintenance problems.

Improved and advanced coal cleaning processes can reduce the sulfur content of many coals to levels conforming to environmental standards without requiring post-combustion desulfurization systems. Other types of coal may be beneficiated to a point where significantly less costly desulfurization systems are needed.

Further, ash removed during the pre-combustion cleaning process, which is generally conducted at the mine site, can be more easily and safely disposed of at the mine than at the utility plant after combustion. While fuel performance benefits due to coal cleaning are expected to provide power plant capital and operating costs savings, it is essential that the users be able to confidently determine the economic trade-off between operational cost savings and fuel cleaning costs. Although recent studies have indicated significant economic benefits associated with coal cleaning, data upon which users can confidently base commercial decisions, exists for only a very limited number of coals.

Costly, large-scale testing is still necessary to generate such data for other coals since broad-based correlations between coal properties and combustion effects are presently inadequate on which to base such decisions. The key to commercialization is to enable the user to confidently make decisions based upon firm technical and economic factors associated with their specific requirements.

Combustion Engineering has teamed with the Electric Power Research Institute and Babcock & Wilcox, Black & Veatch, and Energy and Environmental Research Corporation to develop a broad based, comprehensive program designed to develop the necessary information for commercialization decisions and to demonstrate the benefits of conventional and advanced coal cleaning applications. The project would provide inexpensive coal evaluation procedures, a validated coal quality effects cost model, and a database that would allow utilities evaluate the cost savings resulting from the use of clean coal.

Coals for combustion characterization would be produced at Electric Power Research Institute's Coal Cleaning Test Facility at Homer City, Pennsylvania and would undergo extensive cleanability characterization in conventional and advanced coal cleaning processes, over a range of cleaning levels.

Initial screening tests on a broad cross-section of commercially significant U.S. coals would be used to select eight coal types for detailed characterization. Coals would be selected by DOE and the Electric Power Research Institute to represent those having large reserves, those which are widely used by utilities, and those having good desulfurization potential. The selected coals would undergo extensive cleanability characterization in conventional and advanced coal cleaning processes over a range of cleaning levels at Electric Power Research Institute's Coal Cleaning Test Facility. Laboratoty combustion testing of the parent and cleaned coals would be performed by both Combustion Engineering and Babcock and Wilcox to insure that the results are relevant to virtually all utility boiler designs. All eight coal types, a total of 26 parent and cleaned fuels, would be characterized for combustion performance under this phase of the program. Field data on utility boilers firing each of the parent coals would be obtained for calibration of laboratory results and for correlation with fundamental fuel properties. The field and laboratory results would be used for the development of a generic "Coal Quality Impact Model" to predict the effects of coal quality on power plant performance and electrical generating costs. Development and confirmation of this generic model would be enhanced by parallel boiler performance predictions conducted by both Combustion Engineering and Babcock & Wilcox using their proprietary models. The benefits of coal cleaning would be demonstrated and the reliability of the Coal Quality Impact Model validated during demonstration tests in four utility boilers.

This project would require approximately 36 months to complete. Since the coal cleaning process equipment and coal firing equipment are commercially available, application of this technology could proceed in a timely fashion. While this project requires a rather modest sum for financing, approximately eight million dollars of DOE funding and comparable private funding, it would provide enormous near and long term benefits in cost-effective emission control for the United States Electric Power Industry.

Combustion Engineering's proposed program would fill an important gap as a pre-combustion concept, namely the development and demonstrated benefits of advanced coal beneficiation concepts. Our program, unlike most of the others which demonstrate performance on a single or relatively few coals, would provide important information on a broad range of coals. We believe coal cleaning provides a beneficial foundation that can be effectively integrated with many other technologies. For example, if it is not cost effective to remove all the required sulfur to meet New Source Performance Standards, it may be more cost effective to remove part of the sulfur and apply a minimal amount of sorbent injection as required to meet the standards.

The potential benefits associated with coal cleaning are numerous. Because many of these benefits are directly applicable to current problems facing the utilities, their use of this technology has added attractiveness.

For existing boilers the use of clean coal will increase availability by reducing fuel and ash-related problems that cause unplanned shutdowns. Life extension of the boiler will be significantly promoted by firing clean coal which coincides with the objectives of many utility owners who want to stretch the useful life of their existing equipment. Attainment of additional operating life by firing clean coal would be accompanied by reduced maintenance/operating costs. Situations exist where the use of a clean coal would permit boilers to operate at higher loads due to various fuel-related boiler derating problems. Another increasingly important environmental and economic factor is the difficulty associated with disposal of solid combustion waste products which would be relieved by ash removal at the mine/cleaning site. The use of clean coal with low sulfur levels would obviate or reduce the sorbent requirement for flue gas desulfurization systems. Among the other benefits are reduced capital costs for new boilers and more flexibility in fuel procurement for existing boilers. Clearly the motivation for developing clean coal technology is varied. Although current low oil prices do not now provide much incentive for fuel switching (coal to replace oil) it is only a matter of time before fuel switching will again be dictated by economics.

Combustion Engineering believes the following listing includes imperative reasons which justify the development and demonstration of the proposed combustion engineering clean coal technology program:

- Reduce or Eliminate Flue Gas Cleanup Requirements
- Life Extension
- Lower Maintenance/Operating Costs
- Load Regain
- Increased Plant Availability
- Reduced Slag and Ash/Waste Disposal
- Flexibility in Fuel Procurement
- Fuel Switching (coal to replace oil or gas)
- Capital Cost Reduction on New Boilers

In summary, we believe that coal beneficiation and a demonstration of the benefits derived are an essential element of the Department of Energy's objective of increasing the use of coal in an environmentally safe and efficient manner. It is our opinion that if no pre-combustion clean coal demonstration projects are awarded under this phase of the Clean Coal program, then an immediate effort should be made to appropriate money from the remaining 350 million dollars to address this technology.

Mr. BOUCHER. Thank you very much.

I am going to yield to my colleague from Wisconsin for his questions.

PANEL 3 DISCUSSION

Mr. SENSENBRENNER. Thank you very much, Mr. Chairman. I have a few questions of Mr. Boston, which should come as no surprise to him.

As you know, the entire Wisconsin congressional delegation and the Governor's office supported the Wisconsin Electric application for the Port Washington plan, and we all were disappointed when the DOE did not select it. Doing some postmortem work, it appears that the Wisconsin Electric and the American Electric Power applications for the pressurized fluidized bed combustion projects had approximately the same total costs, but since American Electric Power was able to put together non-Federal funds of approximately 65 percent, the total Federal share was 35 percent, contrasted to the Wisconsin Electric request for 50 percent Federal share.

It further appeared that the State of Ohio used industrial development bonds to put in a significant amount of money into the American Electric Power proposal, and I think it's quite obvious that the difference in the non-Federal share between the two applications was probably the single most important point that tipped the balance against the Wisconsin Electric proposal and in favor of the American Electric Power proposal.

Now, having reached that conclusion, let me ask you if Wisconsin Electric approached the State of Wisconsin for a State contribution for the Port Washington project and, if so, what the response was?

Mr. BOSTON. Mr. Congressman, yes, we did have discussions with various ones within the State of Wisconsin government. The response basically was that the State does not get involved in either issuing industrial development bonds or other methods for financing such projects. They certainly have been very supportive of the project. They think it is a good project, and we certainly have had good cooperation from the agencies with regard to licensing and permitting.

But from a financial standpoint, the response has basically been that they do not get involved in these types of projects.

Mr. SENSENBRENNER. How helpful is it for the utility to receive State funding for this type of research and development project, in your opinion?

Mr. BOSTON. Well, I don't think there is any question that it's helpful. I am sure you understand that to raise the kinds of moneys that we're talking about is an extremely difficult thing to undertake. I am sure that those that are considering supporting the project do look to see what kind of support we are getting from our local State government.

We have been successful in getting some contribution support from a neighboring State, particularly the State of Illinois, and I think it would have helped considerably if we had had support from the State of Wisconsin.

Mr. SENSENBRENNER. It seems to me very incongruous that here the Wisconsin project got financial support from the State of Illinois but didn't get any financial support from the State of Wisconsin.

I looked at the list of successful applicants, and the first round of tentative awards, and Ohio seemed to do very well in which DOE selected, and I think that part of that was due to the fact that the Ohio State government apparently aggressively financially supported the applications that had been sent in by its utilities and its companies, whereas Wisconsin and other States did not.

I would hope that in the future our State would put its money where its mouth is, and perhaps we would be a little bit more successful.

I yield back the balance of my time.

Mr. BOUCHER. I thank the gentleman.

I have a number of questions that I would like to propound to the panel, and I would just call on any who desire to answer them to do so.

First of all, I guess we don't have a clear indication at the present time from the Department of Energy as to when it anticipates finalizing the negotiation with the first-tier winners. When the Assistant Secretary testified yesterday he indicated that one of the contracts perhaps would be finalized by the end of this year, but he would not state with any degree of definitiveness when he would conclude the balance of those contracts. He vaguely indicated that April might be an appropriate time.

All of you are in the position where you are backup winners. You are in a position where you would like, obviously, to be chosen, and in the event that you're still in the position to do so, to commence negotiations with the Department of Energy should that opportunity arise.

I wonder how long, as a practical matter you can remain in that position, how long can you keep your research teams together, how long will you have the capabilities to participate in the event that you're called upon to do so?

As I said, any can answer who desire to do so.

Mr. BOSTON. Mr. Chairman, I might comment. That certainly has been one of the major concerns that I have had ever since the announcement was made. It was also a concern, I think, that we tried to express even while the review was going on. As you commented, and as I indicated a little bit earlier, it's extremely difficult, it's costly, to maintain a team together of the type that we have put together for this particular project, and we are now addressing—actually the executive review board for this project—is addressing on a monthly basis now as to whether we feel that we can continue to maintain the effort.

I will say that we did respond to DOE and indicated that we would be willing to at least allow our application to stand until, I believe it was, March 31, 1987. We will certainly attempt to stand behind that, but I must say that time is of the essence on something like this, and particularly with the major effort that is needed to demonstrate a project such as this, the quicker the better. Right now it's a month-by-month thing as far as we're concerned.

Mr. BOUCHER. So you can hang in there until the end of March of next year; beyond that there is some real question as to your ability to do so?

Mr. BOSTON. We have made the commitment that we will stay together until that time. Beyond that I would say it's very questionable.

Mr. BOUCHER. Could I just get a brief indication from the balance of you as to what the absolute last date is that you feel that you could effectively participate?

Mr. STATHOPLOS. I will speak for combustion engineering's proposal. We likewise have committed to the March 31, 1987, date.

Dr. WOLFE. We are continuing our research program, and certainly we want to try to find ways in which we could continue this effort with or without the Government's support.

Mr. BOUCHER. So you would be able to participate at some point beyond March.

Mr. Smith.

Mr. SMITH. Mr. Chairman, timing is very important for us also. As you might imagine, we cannot make this conversion without having our unit out of service for a fairly extended period of time, and that fits most perfectly in about 1990. We are shooting for that target and working backwards from that date. Timing is critical.

Mr. BOUCHER. All right. Mr. Wait.

Mr. WAIT. With respect to the city of Tallahassee, our retrofit would not require a unit to be out of service except for a very small amount of time, and so that doesn't present a problem to us, although we're somewhat concerned about I understand there is some legislative direction, perhaps by the Senate, to have the DOE report back to retrofit, on retrofit projects, by around March 6.

So our team is together, and they are committed to stay together and that sort of thing, but we have other alternatives to supply our power. So we're not in any immediate danger from that standpoint.

Mr. BOUCHER. Well, I guess that time is of the essence for all of you, though, and you certainly would encourage DOE to move forward as quickly as it can in negotiating these contracts.

It occurs to me that there may be a second opportunity for you quite apart from the failure of DOE to negotiate final contracts with the original awardees. That would involve the second-round solicitation for retrofit technologies, which will be funded at the level, I believe, of $350 million. I think that's the figure in both the House and Senate version of the Interior appropriations bill.

I think the real question is whether or not your technologies are designed in such a way that they would fit the definition of retrofit that the department will adopt or that may be adopted statutorily or through report language.

Have you had an opportunity, any of you, to take a look at the definition of retrofit that is presently being constructed, to see if your technologies would fit within that definition and therefore qualify you to apply in the second round?

Mr. BOSTON. I haven't specifically looked at the language, but from what my understanding is with regard to the language that is in the proposals, the Wisconsin Electric project, or the Port Washington clean energy project, should be able to fit within that definition. We are talking about, in fact, the demonstration project itself is a retrofit of a steam generation system at an existing powerplant, utilizing existing turbine generator and balance of plant.

Mr. **Boucher**. Mr. Smith.

Mr. **Smith**. Mr. Chairman, based on what we understand those definitions to be, we certainly think our project qualifies under those definitions.

Mr. **Boucher**. Dr. Wolfe.

Dr. **Wolfe**. After looking at those, I do think I would certainly ask the Congress to take a look at those retrofit definitions to allow new markets for coal. I am greatly concerned that they are structured primarily towards off-gas cleanup and not converting coal and backing out oil.

Mr. **Boucher**. So, based on that statement, we should endeavor here to ensure that the definition is structured in a broad enough way to take into account precombustion coal cleaning, for example?

Dr. **Wolfe**. Absolutely. And utilization of coal in markets such as the locomotive engine area or heat engines and that sort of thing.

Mr. **Boucher**. Any further comments on that?

Mr. **Stathoplos**. No; I would just back what you said, since our entire proposal was directed at the precleaning technology.

Mr. **Boucher**. I have heard from some members expressions of concern with respect to whether this entire program, the Clean Coal Technology Reserve, equally advantages both high- and low-sulfur coal. I have heard it suggested that perhaps high-sulfur coal is more advantaged than low-sulfur coal.

I know Dr. Wolfe is an officer of a company that produces both high- and low-sulfur coal and has a concern with respect to both.

I wonder if I could get you to comment on how you see low-sulfur coal being utilized as a result of implementing these clean coal technologies. Is there a role for it? Is this something that will advantage one more than the other, or both about equally?

Dr. **Wolfe**. Well, I think the awards certainly do favor Ohio. I think they also favor the higher sulfur regions, 3- to 4-percent-type sulfur. I would also think that they favor the utility utilization of coal.

I do think that we have a major problem in this country, and that is imported oil, and we shouldn't forget that we need to back out oil with coal. I believe that basically the higher sulfur areas have dominated this area. I do think Ohio, with its own funding, has benefited greatly from that. I do believe there is millions and millions of tons of low-sulfur coal available. I think it can be used now in the interim to meet and reduce some of these emissions that do now contribute to the acid rain and this sort of thing.

So, certainly, I think we have that coal available to benefit in the short term while this other technology is being developed in the mid-1990's. We have got another 10 years that we've got to survive in these low-sulfur coal regions, and certainly I would encourage the utilities to look at the option of looking at low-sulfur coal until that technology is available.

Mr. **Boucher**. Mr. Wait.

Mr. **Wait**. Mr. Chairman, in our studies which have gone on really since 1983, when DOE made a study and identified our plant as a good one for conversion, we have looked at burning low-sulfur coal in putting a new pulverized coal boiler with the best available technology, and we have been informed by our Department of Environmental Regulation that we simply—there is no way we can burn low-sulfur coal at our site without putting in the scrubbers.

So this circulating fluidized bed combustion at our site is the only way that we envision being able to make use of our turbine generator balance of plant, that sort of thing.

Mr. BOUCHER. For high- or low-sulfur coal?

Mr. WAIT. Well, for the low-sulfur coal or high-sulfur coal, we could put in scrubbers and do it, but we would have to put those in. We couldn't burn just low-sulfur coal without putting in the scrubbers. The lowest-sulfur coal we could get is——

Mr. BOUCHER. But it's still not compliance?

Mr. WAIT. Yes; we would still be out of compliance burning the low-sulfur coal unless we put in scrubbers. So this technology would enable a new market for coal.

Mr. STATHOPLOS. See, Mr. Chairman, I think the regulations say it doesn't matter what coal percent sulfur that you start with, if you've got to reduce it by 95 percent. So if you take a 1-percent-sulfur coal and you reduce it down to 0.05 percent versus a 4- or 5-percent coal and you reduce it down to 1 percent, to me it makes far more sense to start with a 1-percent-sulfur coal to begin with.

Mr. BOUCHER. Well, it sounds from those answers if the program does not necessarily disadvantage low-sulfur coal, and that is certainly rewarding to hear.

The first-round solicitation had a recoupment requirement, under the terms of which the successful awardees were required to repay the moneys advanced by the Federal Government in the event that they realized a profit as a result of utilizing the demonstration project.

There still is discussion ongoing as to whether or not such a requirement will be included for the second round, for the $350 million for retrofit technologies. One argument against recoupment is that it tends to retard some of the better-quality applications. You all obviously applied and were not retarded in your willingness to do that by the recoupment requirement in the first round.

But what advice do you have with respect to recoupment in the second round? Is this something we should do? If not, give us some reasons why we shouldn't.

Mr. SMITH. Mr. Chairman, Southwestern has no particular problem with the recoupment requirement in the particular project we proposed, and we feel like also, as taxpayers, that it's a wise decision.

Mr. BOUCHER. Mr. Boston.

Mr. BOSTON. Mr. Chairman, we had a problem with it, and I think many of the applicants did. We expressed those during the question-and-answer session in hearings that DOE had at the time after the—or during the period of time that the applications were being submitted.

The problem that we have is that, from a utility standpoint, it complicates the negotiation and the structure. The way that the DOE came out later and indicated that this would be something that would be left for negotiation at a later stance, we therefore did not really comment in the application.

Let me say that we have had excellent support from our local public service commission and from other agencies, but one of the outstanding areas that the public service commission staff has left open is that if we were required with this project to pay back, you might say, what would be a loan rather than a grant, they have not indicated as to how they would address that and whether that would be allowed to be recouped in rates or not.

Mr. BOUCHER. Further comments? Mr. Wait.

Mr. WAIT. Mr. Chairman, we are the only municipal electric utility in the running for this program. We would prefer not to have to repay the grant funds, simply because that adds directly to the costs that our ratepayers have to pay. We are not allowed any kind of a return on ratebase; it's whatever we spend we have to recover directly from the ratepayers. So that's—we don't have any kind of built-in cushion in any way.

Mr. BOUCHER. Well, thank you very much for those comments. We now have a call to the House, and I am going to adjourn the hearing for today.

Without objection, the list of questions which will be propounded by other members to be asked of witnesses who have appeared before this subcommittee during these 2 days of hearings will be accepted into the record, and the record will remain open for the answers to those questions.

I want to thank very much the members of this panel for the very thoughtful testimony they have provided. You have been of great help to us as we have held these hearings.

The subcommittee stands adjourned.

[Whereupon, at 12:40 p.m., the subcommittee was adjourned.]

APPENDIX

STATEMENT BY DR. R. BRUCE GERDING
DIRECTOR, TRW'S COMBUSTION BUSINESS UNIT
ON BEHALF OF TRW
BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
SEPTEMBER 10, 1986

CLEAN COAL TECHNOLOGY

The members of the Committee on Science and Technology are to be commended for the laudable efforts that resulted in the passage of the Clean Coal Technology Program. TRW believes that it is appropriate for the DOE, with the encouragement of the Committee, to foster competition in new technological areas. Multiple sources of a product based on a new technology enhance the creation of a market, thereby benefitting all competitors.

A primary purpose of the Clean Coal Technology Program is to cost-share the final development stage (i.e., commercial scale demonstration) before the product is ready for the marketplace. An excellent example is the Utility Scale Slagging Combustion Retrofit Project. Appropriate support could hasten bringing this mature retrofit technology to the utility marketplace.

TRW has been developing an Entrained Combustion System since 1975. Seven different combustors have been fabricated and have undergone more then one thousand tests leading to the final design of a unit now in advanced testing in Cleveland, Ohio. This Entrained Combustion System consists of a slagging stage, a dense phase feed system that delivers pulverized coal to the combustor, a precombustor, a secondary burner and associated controls. The system has been tested on a wide range of coals and is inherently tolerant of coals with widely varying properties. The mixing technology, which is an outgrowth of TRW's propulsion work, allows coal to be burned with carbon conversion efficiencies in excess of 99 percent. The staged nature of the combustion process leads to NO levels that meet current standards. By adding sorbents at the appropriate stage in the combustion process, SO removal of 50 to 90 percent has been demonstrated at Ca/S ratios of 3/1 for coals with sulfur contents ranging from 0.60 to 2.1 percent.

TRW has invested a great deal of its own funds along with comparable amounts in related R&D contracts (primarily with the DOE). This work has led to the firing of a production prototype in a TRW facility in Cleveland, Ohio. The testing, which began in January, 1986, will culminate in a 4,000-hour endurance run. The demonstration has logged 2,000 hours. The utility-scale retrofit demonstration proposed in response to the Clean Coal Technology PON is the last step before TRW can supply products to the utility marketplace, which involves large combustion systems in multiple-burner applications.

The company's intent and ability to commercialize the technology is clear. Our commitment to the program and progress in developing the Entrained Combustion System place TRW at the home-stretch in the race to market a new generation of environmentally clean coal concepts -- not at the starting gate.

An analysis by the Environmental Protection Agency has determined that to meet the requirements of the Clean Coal Initiative, selected projects should have certain characteristics. These include: projects being suited for retrofitting on existing boilers, able to remove at least 70 percent of sulfur emissions from flue gases, and less costly than flue gas desulfurization scrubbers. As a major utility scale retrofit demonstration which addresses the acid rain issue in a state that borders Canada, this program can be used to address the concerns of our northern neighbors and the United States Congress. Both are interested in near-term retrofit solutions to the acid rain problem. This program could be showcased in the Spring meeting between Prime Minister Mulroney and President Reagan as an example of the United States' effort to address the acid rain problem (i.e., retrofit existing utility stations that exceed desirable emissions limits). It could also be used by the Administration in an attempt to show that sufficient funds are being allocated for retrofit programs based on clean coal technologies.

By acting quickly and decisively, the Administration can address the issues associated with this procurement, foster competition by providing development funds to a newer, less developed version of a slagging combustor, and help the United States commercialize a new internationally attractive commercial product, well ahead of our foreign competition.

WILLIAMS TECHNOLOGIES, INC.
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TULSA, OKLAHOMA 74103
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October 8, 1986

Ms. Marilyn Lloyd
Chairwoman
Energy Research and Production Committee
B-374 Rayburn House Office Building
Washington, DC 20515

Madam Chairwoman and Committee Members:

Thank you for this opportunity to share our thoughts and observations regarding the recent Department of Energy Clean Coal Technology program selecting candidates for DOE funding. I am David R. Williams, Jr., founder of Williams Technologies, Inc., the parent of Carbon Resources, Inc., who submitted a proposal to the Department of Energy as a participant in a joint venture utilizing Carbon Resources, Inc. proprietary coal liquefaction technology.

I share many of the concerns voiced by others regarding a perceived lack of focus by the DOE personified by the candidate selection to address the fundamental problem of cleaning coal to curb acid rain and similar pollution impacts. Very briefly, I have noted that:

- A lack of diversity of coals being investigated, especially the absence of western coals which are generally in the subbituminous and lignite ranking are not represented with,the single exception of an underground gasification program of very long horizon potential. It should be recognized by all in the United States that the western subbituminous coals alone provide the only real transitional energy form from oil to the renewable energy form of the future and make the world's oil and gas reserve pale in comparison to the United States energy reserves of this one coal fuel alone. The great beds of lignite in the west further add to the United States energy reserves but are not being rapidly utilized because they are inherently dirty, therefore demand attention from our clean coal programs.

- Minimal recognition is given the cleaning of coal chemically of elemental sulfur and ash to provide a clean fuel which could then be utilized in existing industrial and utility thermal systems. There appears to be a preoccupation with the removal of the pyritic ash form, which takes with it a portion of the total sulfur in coal, but the chemically bound sulfur, which constitutes well over one-half the total sulfur in coal, is a major contributor to the SO2 emissions and is not removed by pyritic washing techniques.

There are technologies that have been demonstrated in pilot plant operation that are ready for commercial demonstration to chemically clean coal of sulfur and ash but processes selected do not include any of those technologies for sponsorship. Coal chemistry would appear then to be a neglected area for the Clean Coal program and it would be our recommendation that more attention be paid toward removal of the elemental sulfur and ash from the diversity of coals in this country so that they may be burned cleanly and economically to mitigate the pollution problems of coal.

o Lastly, it would appear the 23 candidates selected for sponsorship all employ heretofore demonstrated technologies and by and large have been held to be only incrementally better than other comparative technologies, therefore not meriting private sector testing/demonstration. While this last point may seem harsh, experience and history holds that only technical breakthroughs hold the promise of the quantum step forward which will lead to solving the major problem in the near term, e.g., acid rain. No doubt many new technologies that have been in their developmental stage for 8 to 10 years were suggested for support under the Clean Coal program and it would seem reasonable that one or more of those new technologies which could provide and demonstrate a quantum step forward would have merited support. Coal technologies which are new and have been through their pilot plant are in existence and are available and merit the support of the Clean Coal Technology program.

I thank you for this opportunity to share these thoughts for your consideration in your discussions and evaluations of these programs which impact upon energy research and production. If we can be helpful in the future, please do not hesitate to request our assistance.

Yours very truly,

WILLIAMS TECHNOLOGIES, INC.

David R. Williams Jr

David R. Williams, Jr.

DRW:Theo

COMBUSTION ENGINEERING

Rodney W. Lowman
Director
Government Affairs

September 30, 1986

The Honorable Don Fuqua
U. S. House of Representatives
Washington, D. C. 20515

Dear Mr. Fuqua:

Thank you for holding the September 10 and 11 Clean Coal Technology hearings before your Science and Technology Energy Development and Applications Subcommittee. Combustion Engineering appreciated the opportunity for Mr. Anthony Stathoplos to present the scope of our joint project on evaluating processes for pre-combustion coal cleaning.

As requested during the hearing, I have enclosed for the hearing record two pieces of correspondence endorsing our pre-combustion coal cleaning proposal.

We at Combustion Engineering look forward to working with the Subcommittee and staff as the concept requirements are developed for the proposed supplemental Retrofit Clean Coal Technology Program.

Sincerely,

Rodney W. Lowman

Rodney W. Lowman

Enclosures
rl930lrl
cc: Anthony Stathoplos

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EPRI
Electric Power
Research Institute

April 15, 1986

Dr. Howard Feibus
Chairman
Program Source Evaluation Board
United States Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Dr. Feibus:

The Electric Power Research Institute (EPRI) is pleased to support Combustion Engineering's proposal, "A Clean Coal Demonstration Program for the United States Electric Power Industry," in response to U.S. Department of Energy Program Opportunity Notice DE-PS01-86FE60966. EPRI proposes to act as cosponsor and manager of this project which will result in cost-effective reduction of sulfur emissions from both existing and new utility power stations. The project will provide inexpensive testing procedures, a comprehensive, validated coal quality effects cost model, and a database that will allow utilities to optimize the trade-offs between physical coal desulfurization and electricity generation cost savings resulting from use of clean coal. This project is a logical extension of coal cleaning and combustion R&D being sponsored by both DOE and EPRI.

The proposed prime contractor is Combustion Engineering Inc. (CE). Supporting contractors are Babcock & Wilcox, Black & Veatch, and Energy and Environmental Research Corporation. All proposed contractors would be managed by EPRI under a cooperative agreement between DOE and EPRI. The project will involve use of CE's extensive and unique combustion testing facilities and experience. Coals for combustion characterization will be produced at EPRI's Coal Cleaning Test Facility (CCTF) and will undergo extensive cleanability characterization in actual coal cleaning flowsheets.

Coals to be characterized under the proposed project will be jointly selected by DOE and EPRI to represent those having large reserves, wide availability to utilities, and good desulfurization potential. Eight coals will be characterized at the CCTF over a range of cleaning levels. For each coal, a raw coal sample, a conventionally cleaned sample, and a sample cleaned by advanced techniques will be combustion tested by CE and B&W in laboratory scale and 4-5 MBtu/h test furnaces. The work involves both CE and B&W to

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insure that the results are relevant to both tangential-fired and wall-fired combustion systems, thus broadening the electric generating base to which the project results will be applicable. Upon completion of combustion testing, DOE and EPRI will select four coals for full-scale cleaning and combustion in nominal 200 MW utility boilers. Results from the pilot and full-scale combustion efforts will be used to develop and validate a coal quality effects prediction model currently under development by Black & Veatch for EPRI.

EPRI is committed to supporting the proposed three-year demonstration program and sharing its cost. EPRI believes that successful accomplishment of the project objectives will provide the electric utility industry with a powerful tool to help meet present and future environmental needs and respond to the intent of Public Law 99-29b.

Sincerely,

Kurt E. Yeager
Vice President
Coal Combustion Systems Division

KEY:ml

COMBUSTION ENGINEERING

April 16, 1986

Dr. Howard Feibus
Chairman, Program Source Evaluation Board
Dept. of Energy
1000 Independent Ave., Southwest
Washington, D.C. 20585

Dear Dr. Feibus,

Combustion Engineering (C-E) believes that the development of clean coal technology is vital for satisfying future energy requirements for the U.S. As the world's leading manufacturer of coal-fired boilers, we have a first-hand perspective of our customers needs and a knowledge of the requirements for burning coal in an environmentally acceptable fashion. We believe the subject program brings two very important elements together, namely the benefits of burning cleaned coal and the processes for producing cleaned coal. Superimposed on these two elements is the cost associated with each; obviously there should be a net economic gain associated with cleaning coal. The results from the subject program will allow users of clean coal to make the required economic judgements.

As the prime contractor C-E has sought to team with other organizations whose expertise is required to meet the program objectives. EPRI has offered to co-sponsor this program and to coordinate the technical and fiscal management of the proposed program. C-E along with supporting contractors, Babcock & Wilcox, Black & Veatch, and Energy and Environmental Research Corporation would be managed by EPRI under a cooperative agreement between DOE and EPRI.

C-E has been very active in assessing the benefits of cleaned coal. In the early 1970's C-E decided to make a major commitment to expanded coal research facilities/programs. In the ensuing fifteen years C-E has spent over six million dollars in establishing one of the finest coal characterization programs/facilities in the world. In addition to conducting coal characterization tests on coals from the U.S. as well as other parts of the world, C-E has specifically been involved in assessing the benefits of burning clean coal under programs funded by DOE and EPRI.

The benefits of coal cleaning are many. For existing boilers the use of clean coal will increase availability by reducing fuel and ash-related problems that cause unplanned shutdowns. Life extension of the boiler will be significantly promoted by firing clean coal; this coincides with the objectives of many

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utility owners who want to stretch the useful life of their existing equipment. Attainment of additional operating life by firing clean coal would be accompanied by reduced maintenance/operating costs. Situations exist where the use of a clean coal would permit boilers to operate at higher loads; this could occur where the present coal is causing a slag-related boiler derating problem. Another increasingly important environmental and economic factor is the difficulty associated with disposal of solid combustion waste products which can also be relieved by thorough ash removal at the mine/cleaning site. The use of clean coal with appropriately low sulfur levels would obviate the need for flue gas desulfurization systems. Among the other benefits are reduced capital costs for new boilers and more flexibility in fuel procurement for existing boilers. Clearly the motivation for developing clean coal technology is varied. Although current low oil prices do not now provide much incentive for fuel switching (coal to replace oil) it is only a matter of time before fuel switching will again be dictated by economics or politics.

C-E believes the following listing includes imperative reasons which justify the development and demonstration of the proposed clean coal technology:

- Reduce or Eliminate Flue Gas Cleanup Requirements
- Life Extension (and lower maintenance/operating costs)
- Load Regain
- Increased Availability
- Reduced Slag and Ash Waste Disposal
- Flexibility in Fuel Procurement
- Fuel Switching (coal to replace oil or gas)
- Capital Cost Reduction on New Boilers

We believe this listing reflects an application of commercially emerging approaches to meet present and future environmental demands, a knowledge of utility customers needs and a realistic appraisal of projected business conditions in the utility boiler business. Therefore, the prepared program fully meets the intent of the Program Opportunity Notice DE-PS01-86FE60966.

Sincerely,

COMBUSTION ENGINEERING, INC.

D. E. Lyons
President
Power Systems Group

DEL/lab